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CATHETER AND URINE BAG CHEST DRAINAGE SYSTEM IN A PATIENT WITH
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IATROGENIC TENSION PNEUMOTHORAX FROM IMPROVISED USE OF URETHRAL CATHETER AND URINE BAG CHEST DRAINAGE SYSTEM IN A PATIENT WITH TRAUMA

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ABSTRACT

Introduction: Chest tube insertion is an established cause of iatrogenic pneumothorax and can be associated with significant subcutaneous emphysema. Inspection for reposition, replacement or removal of clogged blockage can be a lifesaving act against fatal tension pneumothorax. If chest tube is to be improvised, adherence to evidenced - based principle of chest tube drainage system with attention to underwater seal principle is essential.

Case Report: A patient with trauma had improvised Foleys catheter and urine bag as chest drainage system with resultant ballooning of the urine bag with air and development of tension pneumothorax.

Conclusion: This report highlights the danger of improvising a chest drainage system while ignoring its scientific basis as a cause of tension pneumothorax.

Keywords: Chest Tube, Tension pneumothorax, Iatrogenic, Improve, Trauma

INTRODUCTION

In 1803, a French physician described the term pneumothorax and during the reign of Alexander the great, pneumothorax was defined by physicians.¹ A pneumothorax is air collection in the pleural space exterior to the lungs.^{2,3} It is classified as spontaneous pneumothorax (without trauma) and traumatic pneumothorax (with trauma), with iatrogenic pneumothorax considered a variant

of the later.³ Disruption of the parietal pleural, visceral pleural and tracheobronchial tree can lead to tension pneumothorax (TN) due to air entry into the pleural space without exit in a one-way valve scenario with intra-pleural space air volume continuing to increase with each breath leading to respiratory distress and mediastinal shift.¹ This phenomenon is termed tension pneumothorax and is a dire emergency.

Iatrogenic pneumothorax (IP) occurs from therapeutic or diagnostic interventions.² With the advent of interventional pulmonology and radiology, a number of transthoracic biopsy, pleural biopsy and trans bronchial biopsy add to procedural complications. Similarly, it may complicate chest tube insertion, central line insertion and use of mechanical ventilation.

An appraisal of 7.5 million uniform hospital discharge abstracts reported an incidence of IP to be 0.115% to 2.68% for mechanical ventilation and thoracentesis respectively,¹ and 0.3% of adult intensive care unit patients, while others attribute the use of small caliber chest tube insertion and Heimlich valve failure as complication leading to TP.^{4,5} The use of improvised Foleys catheter and urine bag as a chest drainage system is not uncommon in Nigeria, a tradition that may be related to poor availability of commercial drainage systems and high costs. This report highlights improvised Foleys urethral catheter and urine bag chest drainage system as a cause for tension pneumothorax. It awakens calls for any medical improvisation to be guided by

evidence-based practice and sound scientific principles.

CASE PRESENTATION

A 27-year-old man was admitted from a remote health facility as a case of trauma that occurred following fall from a tree. There was instant pain and difficulty in breathing which became progressive with no cough or haemoptysis.

Examination revealed a young man in respiratory distress, not pale, acynosed with a pulse rate (PR) of 100 per minute, respiratory rate (RR) of 22 cycles per minute and blood pressure (BP) of 110/70 mmHg.

Chest examination reveals decrease air entry over the right hemithorax and stony dullness to percussion over lower right chest. The chest wall was asymmetrical, trachea was central and there was a swelling/tenderness over right lateral chest wall. Distraction & compression tests were positive. There was hyper-resonance to percussion over the right upper hemithorax with stony dullness basally. Air entry was absent over the right hemithorax except for decreased air entry towards the medial side. There were no crepitations. The left hemithorax had good air entry.

Chest X-ray revealed pneumothorax, subcutaneous emphysema and segmental fracture of the right 3rd rib (Figure 1). An improvised chest tube using a urine bag drained 500mls of blood over a 24-hour period. This did not meet the criteria for massive haemothorax as neither drainage of more than 1500 mls of blood after tube thoracostomy nor drainage of blood of 200mls hourly for at least four (4) hours occurred. Subsequent drainage at days 2 and 3 shows a declining haemothorax of 200mls and 75 mls respectively. However, on day 4, chest distension has increased and progressed to the neck with soft tissue crepitus (Figure 2), drowsiness, worsening of dyspnea and tachypnea (RR-32 cycle per minute). BP was 96/60mmHg. The urine bag was distended with air even after immediate emptying (Figures 3a & 3b). A quick syringe plunger aspiration technique (SPAT) was done using a 5mls syringe for thoracentesis at the 5th

intercostal space mid axillary line which turn out positive for SPAT: 1ml of air is positive and the level of syringe graduation shows correlation to pneumothorax volume while graduation at 5mls and beyond indicates total lung collapse (Figure 4).⁶ An urgent under water seal drainage was made with an improvised plastic water bottle which replaced the urine bag with egress of air from continuous bubbling and subsequent normalization of patient's condition. Supplemental oxygen was given and the patient made good recovery



Figure 1: Chest X-ray showing pneumothorax, fractured right 3rd rib, subcutaneous emphysema and mediastinal shift

DISCUSSION

Blunt trauma to the chest can result from fall from a height and is a cause of pneumo - haemeothorax. The mechanism of injury is barotrauma with burst of the alveoli sac due to sudden rise in intra-thoracic pressure. Disruption of the visceral /parietal pleural can also occur from fractured ribs which can injure the lungs as well.

Chest tube insertion can be a lifesaving procedure for evacuation of pneumo-haemothorax. It prevents the development of tension pneumothorax and aids lung re-



Figure 2: Subcutaneous emphysema with in- situ Foleys



Figure 3a: Air ballooning the improvised urine bag



Figure 3 b: Air in improvised urine bag (closer view)



Figure 4: SPAT is applied and is positive for pneumothorax

expansion in a trauma patient.⁷ The use of chest tube can be associated with complications such as significant subcutaneous emphysema, and inspection for reposition, replacement or removal of clogged blockage may be a necessary requirement for survival of the patient where indicated.⁷ The reported case had worsening subcutaneous emphysema extending to the neck with respiratory distress warranting the inspection of the drainage system. The principle of chest drainage in this patient did not warrant a urine bag as a drainage collection device *ab initio* as air needs to have a venting outlet from the urine bag when filled which is not the case in its design though the blood collected can be emptied through the drain at the bottom of the bag. The drainage urine bag rather than solve the situation, led to an increasing right thoracic air volume in this patient leading to tension pneumothorax.

If the pathology was pneumothorax without haemothorax, the one-way Heimlich valve may suffice as the air exits to the atmosphere.

Furthermore, evacuating haemothorax entails the use of a wide-bore drainage tube due to the viscosity of blood and the likelihood to clot which the Foleys urethral catheter falls short of this. Thus, this reported case having both pneumothorax and haemothorax combined in the right hemithorax merits an underwater seal drainage with a wide bore chest tube or wide bore improvised tube. Experience has shown that Foleys urethral catheter, even of size 32 French gauge, used after prostatectomy get blocked by blood clots despite the fact that urine has abundant urokinase that aids fibrinolysis.

Most IP resolves without complication but a few can progress into tension pneumothorax manifesting with mediastinal shift and respiratory distress.³ Transthoracic biopsy is the most frequent cause of IP.⁵ Patients on mechanical ventilation shows immediate oxygen desaturation and a rapid onset of TP.⁵ Studies have highlighted numerous causes of iatrogenic tension pneumothorax such as surgical tracheostomy in which the 2-year old

patient died as reported by Park et al,⁸ fibre-optic endoscopy (in a 17-month-old) who survived from urgent needle decompression as reported by Mayordomo-Colunga et al.,⁵ small caliber chest tube insertion in a 33 year old multi-traumatized patient that had chest tube insertion, substituted with a Heimlich valve after 24 hours that got dislodged as reported by Moinini et al.,⁴ and ectopic chest tube inserted from the left chest through to the right supraclavicular region showing a large subcutaneous emphysema on CT Scan in a 37 year old poly-traumatized obese patient reported by Saleem et al.⁹

The incidence of morbidity and occasional mortality among emergency trainees who are conversant with chest tube insertion procedure is about 18 % - 30% with higher incidences in critically ill, obese, and multiple-fracture patients.⁹ Whatever the motivation to innovate (be it poor resource setting or stock out), sound scientific basis must take superior guide in drainage of the pleural space and should be patient specific with the device designed to be placed below the chest, allow a one way flow to the drainage device and not back to the pleura which will restore negative pleural pressure aiding lung re-expansion and lastly, allow air and fluid to leave the chest.¹⁰ The innovation with the urine bag in the presented case failed by retaining air ballooned to capacity disallowing further egress of air from the pleural space. The underwater seal principle for a device provides the needed vent for air which was employed as the last resort for the patient. In the words of Alayande et al.¹¹ 'Surgical intervention need not be delayed on account of unavailability or prohibitive cost of custom-made drains in low resource settings.' However, any improvised device must not increase the morbidity and or mortality risks of the patient.

CONCLUSION

This report highlights the danger of improvising a chest drainage system while ignoring its scientific basis as a cause of tension pneumothorax. A simple rule of thumb for clinicians is to use an underwater

seal drainage system for evacuating air, blood, chyle and pus for severely injured or trauma patient with Heimlich devise reserved for non-trauma pneumothorax.

CONFLICT OF INTEREST: None

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