

EXTENSIVE INTERSTITIAL EMPHYSEMA COMPLICATING BLUNT CHEST INJURY

¹E. E. Ekpe, MBBS, FWACS, ²M. C. Ikpe, MBBS, FMCR

¹Cardiothoracic Surgery Unit, Department of Surgery & ²Department of Radiology, University of Uyo Teaching Hospital, P.M.B. 1136, Uyo.

ABSTRACT:

We report the case of a 50-year old farmer who sustained multiple injuries during involvement in a road traffic accident. He sustained blunt chest injury with left lower rib fractures, partial pneumothorax in an area of pleural symphysis, extensive interstitial emphysema, and closed fracture of left femoral shaft.

Initial presentation was to a general hospital and then a private hospital where he was managed during the first five days of the injuries. Since no specific treatment was given to either the pneumothorax or the interstitial emphysema, the latter continued to progress to a frightening and life-threatening proportion thereby necessitating referral to our centre on the sixth post-injury day.

Examination showed a middle aged man that was 'ballooned' from face to legs, in respiratory distress, breathing through an opened mouth, complete and bilateral ptosis due to swollen / ballooned eyelids, and talked with 'nasal voice'. There were extensive subcutaneous crepitus from the face to the legs, positive chest compression tenderness over left lower aspect, hyper resonant percussion note, and diminished intensity breath sound worse over left lower lung zone, and widespread crepitations. The trachea was centrally located. Examination of the left lower limb revealed simple fracture of left femoral shaft.

The clinical diagnoses of blunt chest injury with left lower rib fractures and partial left pneumothorax and extensive interstitial emphysema, and closed left femoral fracture were confirmed radiologically. The patient was successfully treated with left closed tube thoracostomy drainage, supplemental oxygen therapy, analgesic and supplementary parenteral nutrition, with complete resolution of interstitial emphysema by the eighth post-intubation day.

Keywords: *Interstitial emphysema, chest injury.*

INTRODUCTION:

Interstitial emphysema is escape of air from the pulmonary alveoli into the connective tissue of the lung, mediastinum, pericardium, subcutaneous tissue, or muscles.¹ It commonly results from a tear or rupture of the respiratory passages or alveoli, which may occur in association with bronchiolar obstruction, positive pressure ventilation, or a penetrating or blunt wound of the chest wall or lung.¹ Interstitial emphysema is variously described as subcutaneous emphysema when the air is present in the subcutaneous layer of the body wall, surgical emphysema when it complicates a surgical procedure, traumatic emphysema when it is due to trauma, mediastinal emphysema when the air is present in the

mediastinum, and pneumopericardium when it is present in the pericardium.^{1,2,3,4}

Subcutaneous emphysema which is also called cutaneous emphysema or pneumoderma remains the commonest type of interstitial emphysema.¹ This is because when air escapes into the soft tissue of the chest wall, the skin will prevent egress of the air and since muscle is dense and cannot be easily dissected by the air, most of the air spread through the subcutaneous tissue planes.¹ If the subcutaneous emphysema is excessive, it will extend up into the face from tissues of the neck, sometimes inflating the eyelids until they are forced to close.^{1,5} Extensive subcutaneous emphysema extends down the abdominal wall into the scrotum and the lower limbs. When not progressive, the attachments of inguinal ligament may limit extension of subcutaneous emphysema beyond the scrotum further distally.^{1,5} Mediastinal emphysema is also called pneumomediastinum.¹

Interstitial emphysema may occur from the same mechanisms that produce haemopneumothorax, especially in patients with injury in an area of pleural symphysis from previous trauma or inflammation.¹ Subcutaneous emphysema is common with blunt chest trauma especially with multiple rib fractures.^{1,2} If a tension pneumothorax is present, subcutaneous emphysema may quickly become extensive, especially if the patient is on positive pressure ventilation.^{1,5}

Injury to the trachea, main stem bronchus, or oesophagus may produce isolated pneumomediastinum.^{1,5} Subcutaneous emphysema or a pneumothorax may occur in patients with barotrauma secondary to a blast injury or valsalva manoeuvre.¹

Patients with extensive interstitial emphysema present frightening and progressive body swelling, and respiratory distress. Associated injury to other organ system may modify presentation. The classical examination findings are the subcutaneous crepitus felt on palpation of the ballooned skin, hyper resonant percussion note, and markedly decreased breath sound over area of pneumothorax or haemothorax and coarse crepitations on auscultation of the affected areas.^{1,6}

Chest radiograms are diagnostic with radiolucent layer beneath the skin, extending into the neck and abdomen. Dissection of pectoralis muscle fibres by air can also be seen in extensive interstitial emphysema.^{1,6} Chest radiogram may also show multiple rib fractures, and pneumothorax in an area of pleural symphysis. It can also diagnose tracheo-bronchial injury when pneumothorax is present with downward displacement of the hilum of the lung.^{1,2,6} Contrast oesophagogram and oesophagoscopy, and bronchogram and bronchoscopy should be done to exclude oesophageal perforation and tracheo-bronchial injury respectively.^{1,6}

CASE REPORT:

We report the case of a 50-year old farmer who presented with sharp pain on the left side of the chest, progressive body swelling and difficulty in breathing, and pain and inability to use the left lower limb six days following involvement in a road traffic accident. He was a passenger on a motorcycle that developed burst tyre while moving on speed. The rider lost control and both of them fell down and the motorcycle fell on the patient's left side of the chest and left thigh. He developed left-sided chest pain that was sharp in nature, moderate in severity and aggravated by deep breathing but relieved by shallow breathing and non-steroidal anti-inflammatory drug. There was no open wound on the chest, no history of associated cough or haemoptysis.

About six hours after the accident, the patient developed a frightening swelling of left side of the chest wall which progressively extended to involve all parts of the chest wall, neck, face and eyelids, abdominal wall, scrotum and both lower limbs. He also developed a nasal voice and progressively worsening difficulty in breathing, breathing through the opened mouth. He was also unable to open both eyes because of eyelid swelling.

He was unable to raise the left lower limb because of painful swelling and abnormal movement in the thigh. There was no history of loss of consciousness or otorrhinorrhoea.

The patient was initially taken to a general hospital and then a private hospital within the city where the accident occurred, where he spent five days on treatment without improvement, and hence the referral to our centre.

On examination he was found to be a middle-aged man in moderate respiratory distress, ballooned from face to legs, with bilateral ballooned eyelids and complete ptosis. He had nasal intonation of the voice, bull neck, mild central cyanosis and mild mucous membrane pallor (fig 1). The body swelling was soft, non-tender and with subcutaneous crepitus. He had normal body temperature, tachycardia of 102 beats/minute, moderate volume and regular, and blood pressure of 130/70 mmHg. The respiratory rate was 36 breaths/minute, the chest wall was ballooned and subcutaneous crepitus was palpated. Chest compression tenderness was positive over the left lower ribs. Percussion note was hyper resonant and breath sound was vesicular with diminished intensity globally but worse over the left lower lung zone. There were widespread coarse crepitations auscultated during both phases of respiration. The trachea was centrally located.

The cardiovascular system was stable, and the abdominal examination was otherwise normal. Genito-urinary system examination revealed involvement of the scrotum by subcutaneous emphysema. Musculo-skeletal system examination also revealed extension of subcutaneous emphysema into all limbs; and closed fracture of the left femoral shaft.

Clinical diagnoses of road traffic accident with blunt chest injury, left lower rib fractures, left pneumothorax and extensive interstitial emphysema, and left femoral shaft fracture, were made. The patient was nursed in Fowler's position, given supplemental oxygen therapy by facemask at 4L/minute, complimentary parenteral nutrition, and oral fluid taken through a straw. The fractured lower limb was immobilised by skin traction kit.

parenteral nutrition, and oral fluid taken through a straw. The fractured lower limb was immobilised by skin traction kit.

Urgent postero-anterior chest radiogram revealed extensive radiolucent shadows in the soft tissues outside the lung, pneumomediastinum, subcutaneous air trapping, supporting the diagnosis of extensive interstitial emphysema, fracture of left ribs numbers 7 to 10 inclusive, and radiolucent shadow in the infero-lateral aspect of left hemithorax devoid of lung's vascular markings, consistent with pneumothorax in an area of pleural symphysis (fig 2).

Closed tube thoracostomy drainage with a size 32 French gauge thoracic catheter was done ensuring that all the fenestrations of the tube went into the left partial pneumothorax space. Antibiotic, analgesic and haematinics were also administered, and the orthopaedic surgeon was invited for the treatment of the fractured left femur.

The patient's condition progressively improved following institution of closed tube thoracostomy drainage with progressive resolution of interstitial emphysema, respiratory distress and return of normal voice. By the 5th day on closed tube thoracostomy drainage the interstitial emphysema resolution was complete (fig.3), the chest tube was removed, and the patient discharged to orthopaedic unit for the left femoral fracture treatment.

He has remained well more than 22 months after treatment.



Fig.1: Clinical photograph of subcutaneous emphysema patient on presentation

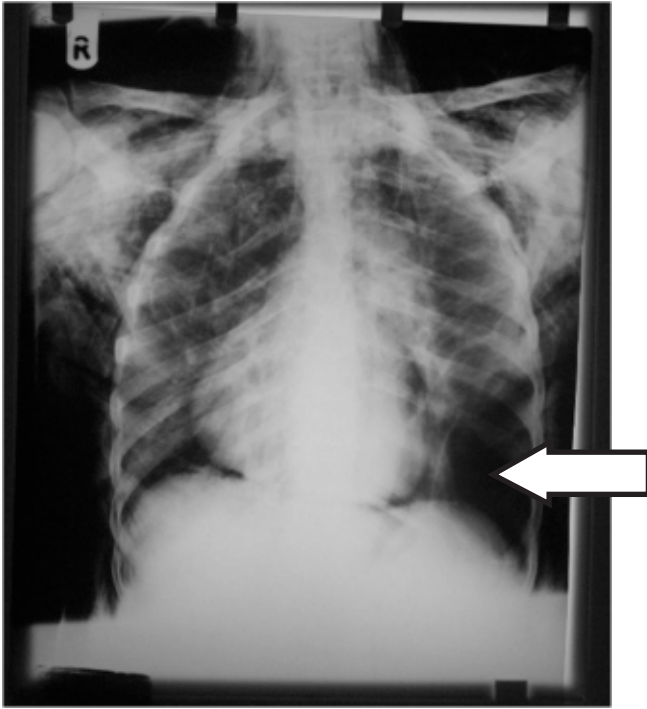


Fig.2: Plain chest radiograph of patient with extensive traumatic emphysema. Note area of partial pneumothorax / pleural symphysis (arrow head).



Fig.3: Same patient on the 5th post-intubation day. Note complete resolution of subcutaneous emphysema.

DISCUSSION:

Interstitial emphysema follows escape of air from a damaged lung or air passage which then finds its way into the chest wall and subcutaneous layer through tear(s) in the parietal pleura.¹ This was the most likely mechanism in the patient reported on who sustained blunt chest trauma. It is occasionally associated with an open chest wound, when external air finds its way into the tissues.⁷

Its speed of accumulation gives some indication of the degree of air-leak and those patients who become ballooned up very rapidly should be suspected of having rupture of a main bronchus.^{1,5} Interstitial emphysema is often associated with a partially or completely obliterated pleural space, or with severe pulmonary emphysema.¹ Under these conditions, collapse of the lung with pneumothorax formation occurs less readily.¹ Our patient sustained blunt chest injury with rib fractures over an area of partially obliterated pleural space (pleural symphysis). This was shown by the chest radiograph (fig.2). The pleural symphysis was therefore responsible for the rapid and extensive interstitial emphysema. The pleural symphysis also prevented complete lung collapse and tension pneumothorax with mediastinal shift (fig. 2). This was thought to be a significant contributor to the survival of this patient who did not receive proper treatment for five days following the injury. A previous review of cardiothoracic surgical emergencies in the same institution showed that rib fractures were the second commonest type of chest injury.⁸

A large pneumothorax associated with subcutaneous emphysema usually implies a large air-leak. The emphysema occasionally spreads rapidly to involve the entire chest wall and abdomen, sometimes with massive enlargement of scrotum and may extend to the feet, and neck and face as high as the insertion of the scalp aponeurosis.^{1,5} This picture was seen in our reported patient who became grotesque, being ballooned up to resemble a 'snowman' (fig. 1).

Chest radiograph was characteristic, demonstrating the presence of air in the subcutaneous layer and fascial planes, the presence of air among the fibres of pectoralis major muscle clearly outlines their fan-like appearance (fig.2) The partial left pneumothorax also shown on the radiograph of the patient was as a result of pleural symphysis perceptibly resulting from previous pleural inflammation as there was no past history of chest trauma in the patient.

The treatment of closed tube thoracostomy drainage applied to the patient helped by providing a path for escape of air from the pleural cavity to the exterior. This prevented progression of interstitial emphysema, and allowed its resolution on the fifth post-intubation day (fig.3). This form of treatment is the widely accepted treatment as opposed to the ancient method of treatment which utilized multiple skin incisions to serve as paths for egress of air from the body wall.^{1,5,6,8,9,10} The multiple skin incisions were commonly complicated by bacterial inoculation and septicaemia.¹ Other resuscitational measures and supportive treatment including prophylactic antibiotic helped to prevent pleural space sepsis which is otherwise common in breached pleura.^{1,9,10}

REFERENCES:

1. Mattox KL, Wall M Jr: Thoracic Trauma: In Baue AE (Ed.) Glenn's Thoracic and Cardiovascular Surgery; 6th ed. Appleton & Lange. Stamford, Connecticut, 1996; 95-96.
2. Omole O, Mamman M, Nkanta C: Multiple Rib Fracture with Surgical Emphysema at 34 weeks Gestation. Highland Medical Journal. 2004; 2: 79-80
3. Cummings RG, Wesly RLR, Adams DH: Pneumopericardium resulting in Cardiac Tamponade. Ann Thorac Surg. 1984; 37: 511-513
4. Shorr RM, Mirvis SE, Indeck MC: Tension Pneumopericardium in Blunt Chest Trauma. J Trauma. 1987; 27: 806-808.
5. Reul GJ Jr, Mattox KL, Beall AC Jr, Jordan GL Jr: Recent Advances in the Operative Management of Massive Chest Trauma. Ann Thorac Surg. 1973; 16: 521-562.
6. Glinz W: Chest Trauma: Diagnosis and Treatment. West Berlin, Springer Verlag, 1981; 54-71.
7. Adkins RB, Whiteneck JM, Woltering EA: Penetrating Chest wall and Thoracic Injuries. Am Surg. 1985; 51: 140-148.
8. Ekpe EE, Nottidge T, Akaiso OE: Cardiothoracic surgical Emergencies in a Niger Delta Tertiary Health Institution: A 12 Month appraisal. Ibom Medical Journal. 2008; 3: 22-29.
9. Bricker DS, Mattox KL: About Chest Tubes. Current Concepts In Trauma Care 1979; 2: 16-19.
10. LoCurto JJ, Tischler CD, Swan KG, et al: Tube Thoracostomy and Trauma antibiotics or not? J Trauma. 1986; 26: 1067-1072.