Early Postoperative Malignant Subcutaneous Emphysema: Report and Review

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Abstract

Background Subcutaneous emphysema is defined as presence of air or gas in subcutaneous tissue layer. It may be localized or generalized due to various aetiological factors. Although SE and pneumomediastinum are self-limiting conditions, life-threatening complications may develop. Escape of air into both pleural cavity causing bilateral pneumothorax and tension pneumothorax can be termed as malignant emphysema.

Purpose To report a case of malignant generalized subcutaneous emphysema in early postoperative phase following palatoplasty.

Case Report A 25 year old female patient was operated for closure of residual oronasal communication using an anteriorly based tongue flap. The patient was reversed from general anesthesia and shifted to the post-operative room with the endotracheal tube in situ. Sudden swelling of the face and periorbital area was noticed which spread all over the body. A diagnosis of malignant post-operative subcutaneous emphysema was made and the patient was shifted back to the operation theatre. She was managed successfully by bilateral tube thoracotomy and tracheostomy.

Conclusion Close observation of the patient in early postoperative stage having endotracheal tube in situ is crucial to avoid such complication. Regardless of aetiology, early recognition of the clinical features of tension pneumothorax and timely intervention are necessary for the survival of the patient.

Keywords Subcutaneous emphysema · Tension pneumothorax · Tracheostomy

Introduction

Subcutaneous emphysema (SE) is defined as presence of air or gas in subcutaneous tissue layer. It may be localized or generalized. Emphysema of maxillofacial area due to use of high speed drills like airoter, pressurized air and water jets, hydrogen peroxide irrigation and fractures involving para nasal sinus are self-limiting and localized in nature. Generalized emphysema is associated with trauma to the respiratory system or esophagus [1]. Non traumatic emphysema may be due to pathological changes in respiratory tract [2]. Generalized surgical emphysema has been reported following maxillofacial trauma, rib fracture [3], open pelvic fracture [4], laparoscopic surgery [5], cricothyrotomy, pneumonectomy, thoracotomy [6] and positive pressure ventilation. One of the rare complications of maxillofacial surgical procedures is malignant subcutaneous emphysema. It can be life threatening if it occurs during or immediately after a major surgical procedure and not diagnosed at the right time. We report a case of malignant generalized subcutaneous emphysema in the early postoperative phase of an adult cleft lip and palate patient operated for palatoplasty using an anteriorly based tongue flap. The aim of this article is to emphasize the need

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of meticulous monitoring in the immediate post-operative care of patients who are conscious and having nasotracheal tube in situ.

Case Report

A 25 year old female patient was referred to the division of maxillofacial surgery for closure of residual oronasal communication. She was an operated case of bilateral cleft lip and palate (CLP). Past medical history revealed that she was operated for primary closure of bilateral cleft lip at the age of 9 months, palatoplasty at 4 and 8 years and secondary cheiloplasty at 9 years. She was undergoing orthodontic treatment at our center. She was operated for posterior segmental osteotomy and palatal expansion using HYRAX appliance. The residual oronasal communication gradually increased in size and she developed nasal regurgitation.

She was evaluated clinically and radiologically using 3D reformatted computed tomography (CT) for the amount of soft tissue and bony defect. Various surgical options were discussed with the patient and her parents. The decision to close the palatal defect with a tongue flap was taken as the patient was unwilling for further surgery and was just keen to get the oronasal communication closed. She was taken up for closure of the anterior palatal defect using an anteriorly based tongue flap under general anesthesia by nasal intubation. Ryle's tube was placed and secured with adhesive tape.

The size of the defect was measured and Xylocaine 2 % with adrenaline (1:80,000) infiltrated. The graft bed was prepared by sharp dissection and eversion of margins. An adequate size of anteriorly based tongue flap was marked and infiltrated. Sharp dissection was carried out to raise the flap including a layer of muscle. Hemostasis achieved and the donor site defect was closed primarily (Fig. 1). The flap was inverted facing the raw surface superiorly and sutured to the recipient site with 3-0 Vicryl (Fig. 2). The tongue was passively fixed to the palate using interdental sutures for temporary immobilization of the flap. The patient was reversed from general anesthesia uneventfully and shifted to the post-operative room with the endotracheal tube in situ as postoperative complication was anticipated because of fixation of the tongue. After about 10 min sudden swelling of the face and periorbital area was noticed and the patient started gasping for breath. She was highly distressed and passed urine. The swelling spread to temporal area, neck, breast, axilla, abdomen, genitalia and thigh. The oxygen saturation (SPO2) fell to 81 %. She was bloated up and crepitus was felt throughout the body (Fig. 3). The abdomen too was distended. A diagnosis of malignant post-operative subcutaneous emphysema was

Fig. 1 Anteriorly based tongue flap and wound closure

Fig. 2 Flap sutured to the recipient site

made and the patient was shifted back to the operation theatre and the emergency team was activated. The following steps were taken, (a) endotracheal suction and securing the airway through the existing endotracheal tube and induction of general anesthesia (b) simultaneous bilateral percutaneous thoracotomy using a 16 gauge IV cannula attached to underwater tube which was inserted in between the 2nd and 3rd intercostal space to check for tension pneumothorax. This step confirmed the presence of a tension pneumothorax bilaterally. Third step was bilateral tube thoracotomy. The stopper of the Ryle's tube was removed and a sudden gush of air was released leading to recovery of abdominal distension. The blood gas and cardiac parameters improved significantly. The signs of distress reduced but generalized subcutaneous emphysema

Fig. 3 Malignant subcutaneous emphysema

was present. Fourth step was tracheostomy which was done using the standard surgical procedures. The endotracheal tube was deflated and removed and a Portex double lumen cuffed tracheostomy tube (Smith medical, USA) was placed to secure the airway. Ryle's tube was aspirated. Within a few minutes the signs and symptoms of subcutaneous emphysema with tension pneumothorax began to subside and the patient's general condition started to improve. Fiber optic bronchoscopy and upper gastro intestinal (GI) endoscopy was carried out to rule out any injury. The tongue flap was not disturbed. The patient was shifted to the intensive care unit for further monitoring. The signs of subcutaneous emphysema started to improve in the next 24 h. Crepitus could not be palpated and the chest tubes were removed. The tracheostomy tube was removed on 4th day and stoma was allowed to close secondarily with the help of pressure dressing. The patient was discharged on 5th day (Fig. 4). After 2 weeks the tongue pedicle was divided under local anesthesia. The flap uptake was satisfactory and did not require any debulking. She was reviewed periodically and continued with orthodontic treatment.

Discussion

Surgical emphysema is often used to refer to perioperative or post-operative subcutaneous emphysema involving the cervicofascial region. Early recognition of the underlying cause is essential to formulate the treatment plan [7]. It may be due to trauma to the soft tissues of the pharynx,

Fig. 4 Patient on 5th post-op day

hypo pharynx and trachea during traumatic intubation, over inflation of the endotracheal tube cuff, repeated intubation attempts, re-positioning of the endotracheal tube without deflating the cuff, stylet protruding beyond the endotracheal tube traumatizing the trachea, patient movement or coughing during intubation and patient head and neck movement after intubation [8, 9]. Patient factors in addition to tracheal injury can be congenital tracheal anomalies, weakness of the membranous trachea, chronic use of steroids and chronic obstructive pulmonary disease [10, 11]. The clinical features may appear during the mechanical ventilation or during early postoperative stage as in our case. Nevertheless, detectable symptoms and signs may also be observed after a delayed postoperative period [12]. Worrell has suggested a 4 point scale to measure postoperative SE following laparoscopic surgery, 0: no SE, 1: mild SE with crepitus at trocar insertion site, 2: marked emphysema of abdomen and thigh and 3: massive emphysema extending to chest, neck and face [5].

Our patient is a known case of bilateral CLP who has undergone multiple surgeries under general anesthesia. The nasal intubation was difficult and repeated manipulation of the endotracheal tube was done to achieve a successful airway. A cuffed 6.5 mm diameter flexometallic tube was used. The difficulty in intubation may be due to developmental and surgical distortion of air way which might have caused trauma. Fiber optic bronchoscopy ruled out any injury to tracheobronchial tree. Ryle's tube insertion after intubation might have caused trauma to upper GI tract. Repeated aspiration GI content did not reveal any fresh or occult blood. Upper GI endoscopy ruled out any trauma. No throat pack was given as the plan was to transfix the tongue to palate. Hence mechanical trauma was ruled out as the etiological factor for early postoperative malignant subcutaneous emphysema.

The surgical procedure was aimed to close the oronasal communication. The tongue flap created a mechanical

barrier between the nasal and oral cavity. Mouth breathing and swallowing were difficult due to fixation of the tongue to the palate. Only nasal breathing was possible. Encroachment of the nasal air way by the flap, edema and oozing may lead to respiratory embarrassment. Anticipating the difficulty in nasal breathing during the early post-operative phase the endotracheal tube was left in situ after recovery from general anesthesia. Hence the likely chain of events could be partial or complete obstruction of endotracheal tube due to secretions lead to barotrauma. Damage to the lung parenchyma due to barotrauma manifested as bilateral tension pneumothorax and development of generalized malignant SE. The term malignant is used to describe the sudden onset and extensive nature of emphysema. Escape of air into both pleural cavity causing bilateral pneumothorax and tension pneumothorax can be termed as malignant emphysema [13]. Gasping for breath led to aerophagia and distension of abdomen which further worsened the condition of the patient.

Regardless of the etiology, early recognition of the clinical features and timely intervention are necessary for the survival of the patient. Although subcutaneous emphysema and pneumomediastinum are self-limiting conditions with rapid recovery with conservative treatment, life-threatening complications may develop. The usual symptoms that herald this complication are subcutaneous and mediastinal emphysema, hemoptysis and in severe cases dyspnea and cyanosis [14]. Spontaneously occurring SE presents with clinically impressive and dramatic features [15]. Tension pneumothorax in patients with tracheal injuries may be the cause of acute cardiorespiratory failure. Clinical features of traumatic tension pneumomediastinum mimics cardiac tamponade [16]. Malignant SE is diagnosed by clinical features. Chest radiograph and CT scan are of great help to confirm the diagnosis of SE in non-emergency conditions. In radiograph it appears as radiolucent striations surrounding the muscle fiber bundles known as 'ginkgo leaf sign' [17]. Air pockets appear as dark areas in CT scan. The location of air leak can be ascertained in CT scan. Ultrasound is not effective in presence of air.

A small laceration through the pyriform mucosa is enough to produce significant subcutaneous emphysema [18]. More than 80 % of the injuries to the trachea are within 2.5 cm of the carina [14]. Bronchoscopy is necessary to confirm the exact location and extent of the tracheal injury. A thorough bronchoscopy and upper GI endoscopy was carried out in our case to rule out any inadvertent trauma.

Subcutaneous emphysema in itself is not a life threatening complication. Management depends upon etiology and severity of the clinical condition. Postoperative malignant SE and tension pneumothorax is a life-threatening emergency which mandates aggressive management.

The first step is to relieve tension pneumothorax by needle thoracotomy followed by tube thoracotomy which was carried out in our patient. Though the air way was secured by nasotracheal intubation, we performed tracheostomy anticipating longer mechanical support and to avoid further complication. Chest and mediastinum decompression with tracheostomy can be lifesaving [19]. In case of tracheal injury early surgical treatment will prevent complications like mediastinitis and tracheal stricture [20, 21].

In spite of not being able to determine the exact cause of the subcutaneous emphysema in our case a prompt management saved the patient from a life threatening complication. It had no impact on treatment outcome of oronasal communication. The recovery was uneventful and the patient continued with the orthodontic treatment.

Compliance with Ethical Standards

Conflict of interest None.

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