Case Report

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Peri-Orbital Subcutaneous Emphysema Complication Associated with Third Molar Surgery: 2 Case Reports and Review of Literature

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ABSTRACT

Background: The introduction of air into subcutaneous tissue during dental procedures can be harmful. However, subcutaneous emphysema is common in third molar surgery when the procedure requires tooth sectioning with an airoter which is usually restricted to moderate local swelling, but peri orbital extension is a rare condition. This review explains the possibility of aetiology, signs and symptoms; potential path of spread and differential diagnosis and protocol of its management are discussed with presentation of peri-orbital emphysema and a generalised subcutaneous emphysema case involving head and neck as an intra operative complication of third molar extraction.

Keywords: Subcutaneous emphysema, third molars, peri-orbital, aetiology, emphysema spread, management.

INTRODUCTION

Subcutaneous emphysema (SCE), also called tissue emphysema (TE) or surgical emphysema (SE) occurs when gases or air is present in subcutaneous layer of the skin. Subcutaneous refers to the tissue beneath the cutis of the skin, and emphysema refers to air entrapment. Entrapment of air within the tissue spaces can be localised or generalised, confining to the area of surgery which can be unilateral[1] or bilateral[2] in some extreme cases. Subcutaneous emphysema is reported by many authors as a result of surgical and nonsurgical procedures in oral surgical[1], conservative and endodontic[3] and periodontics[4] Procedures in dentistry. It is more common in third molar surgeries[5,6]. This complication may still occur in the best of the hands and skills of the practitioners [6, 7].

It is an uncommon clinical complication in the present scenario with advancement in the clinical situation and material management. This is mainly due to forcible injections of pressurized air into the loose connective tissues below the dermal layers caused by high speed air turbines driven by compressed air at 3.5 to 4 kgf/cm [2], rotating at 450,000 rpm [8]. As the air gets entrapped within the tissue it may remain locally at the surgical site or may spread along the loose connective tissue. This is presented as local swelling, tenting of the skin and crepitation's and palpations [9]. In extreme cases, air could pass inferior through the masseter space into the Para pharyngeal and retropharyngeal areas further spreading into mediastinum [8] the spread posteriorly and / or laterally into the infratemporal and pterygopalatine fossa and the steroid plexus. The spread to the eyelid is by perforations from the preseptal spaces.

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This paper describes the possible aetiologies, clinical symptoms differential diagnosis and management of the condition. Two cases of subcutaneous emphysema occurred during third molar extraction is presented below. The cause was due to the use of air turbine hand pieces during surgical procedures.

ETIOLOGIC FACTORS

Physiologically, SE can occur as a complication that increases intra oral pressure following dental procedures commonly during third molars extraction [10] It can also be observed following facial injuries [11] Involving the mid face, nasal and Para nasal sinuses, intubations during general anaesthesia due to hypopharyngeal [12] .or endotracheal [13] Injuries. Possible theory for general anaesthesia emphysema demonstrates due to oxygen administration with a mask during the procedures. SCE occurring during dental procedures while using high-speed air or water drills has been documented in the dental literature. It can be caused by the invasion of compressive air into soft tissues through the disrupted intra oral barrier (dento-alveolar membrane or root canal) during tooth extraction (particular of the third mandibular molars) [14] . The underlying mechanism is a disruption of the intraoral barrier allowing air under pressure to tract subcutaneously.

Facial emphysema can also result from a series of technical errors [15] such as the enlargement of the perforation which increases the chances of injuring the periodontal tissues [4] and entering air into the tissue spaces. Many cases of air entering tissues are complicated by inflammation and infection from opportunist microbes from other sources within the body that find the inflated space. Further risk is found in the fact that typical dental air sources do not provide sterile air.

ANATOMIC PATHWAY DIFFUSION

The prime area of air entering into anatomical spaces appears to be the root canal space. But it can sometimes pass through the dento alveolar membrane [16] . Following its introduction into soft tissues air remains in the subcutaneous connective tissue and does not spread to deep anatomical spaces in the majority of the cases; however emphysema can also involve deeper structures as the tissue planes commonly connect [17].

The potential route for travel of compressed air, involves the superficial region, the parotid region, the submandibular and sublingual region, the tonsillar and masticator region and the Para pharyngeal and retropharyngeal spaces (danger space) were accumulation of air may lead to airway compromise. Further the air extends to the mediastinum to the pleural cavity, the pericardium and even the retroperitoneum [14]. Air which is introduced into the facial planes may present [3] potential Sequela, initially; it can remain in the space until it is absorbed. This leads to the ballooning (emphysema) of tissue and the occurrence of crepitus along the overlying involved tissues, immediately after air entrapment [18] .secondarily it can escape along the path of introduction such as the surgical wound or patent root canal and may be released into room air, causing no damage. Finally, it can enter a blood vessel in a large volume to cause obstruction of coronary flow, resulting in cardiac air embolism, resulting in cerebral ischemia (stroke).

SYMPTOMS AND DIAGNOSTIC FEATURES

The most common clinical feature of the SCE is rapid swelling of the face and sometimes the neck [16] . However, it is usually restricted to discrete local swelling and tenderness [7] . The affected area becomes puffy and in almost every case crepitus may be elicited on palpation. Edema or lymphadenopathy [19] may also be observed. Pain is variable and is usually of short duration [16] . Some patients experience sharp pain as the swelling appears. Other patients complain of fullness due to the enlargement of the area. If the swelling involves the neck there is generally some discomfort or difficulty in swallowing, but this very rarely appears to be a respiratory embarrassment. The initial change is soft tissue enlargement due to the presence of air in deeper tissues. Subsequently the enlargement increases and spreads due to secondary inflammation and oedema. Facial erythema and mild fever may occur. Significant spread into the mediastinum can result in dysphagia or dyspnoea. Stabbing pericardial chest pain is more common complaints of patients with pneumomediastium is associated with stretching of

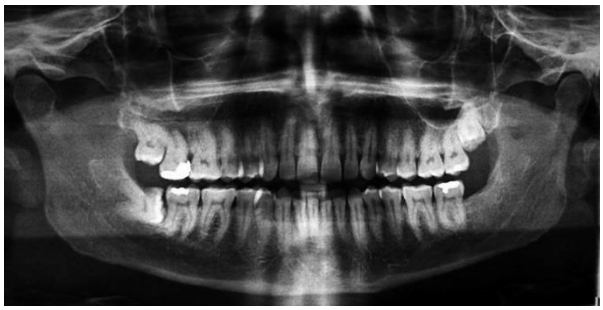

Fig 1: Preoperative radiograph.

Fig 2: Intra operative swelling.

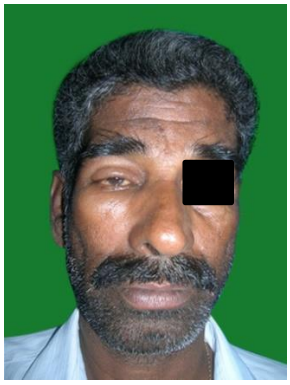

Fig 3: Fifth postoperative day.

Fig 4: Peri orbital swelling intra operative.

Fig 5: Preoperative radiograph.

interstitial soft tissues caused by dissection of air. Other features suggestive of pneumomediastium are dysphonia with brassy voice, chest or back pain and hamman sign which is crunching and bubbling sound caused by movement or air accompanying cardiac pulsation.

While the SCE should be detected by physical examination and alert radiologist often makes the diagnosis. Radiographic examination consists of a panoramic and an anterior posterior radiograph [17] . The SCE can also be seen in ultra sound or CT scans with the air pockets appearing as dark areas. CT scanning is so sensitive that it commonly makes it possible to find the exact spot from which air is entering soft tissues.

DIFFERENTIAL DIAGNOSIS

Diagnosis of severe SCE can be misleading, when it occurs after a dental procedure. Differential diagnosis of SCE should be made from an allergic reaction [16] , gas gangrene, infection, hematoma, and angioneurotic oedema.

The allergic reactions are far more severe than SCE, with skin manifestations. In gas gangrene, severe systemic reactions with disagreeable odour and marked pain are often reported, associated with deep wounds. Spongy rapid swelling without crepitus and discoloration of the skin is the characterise feature of hematoma. In angioneurotic oedema, circumscribed areas of oedema, preceded by a burning sensation may appear on the skin or mucous membrane [16] .finally in those cases where general anesthesia was performed, subcutaneous emphysema might be misdiagnosed as a delayed

hypersensitivity reaction to general anaesthetic.

CASE REPORT 1

A 48 years old male patient was referred to the department of oral maxillofacial complaining of pain in relation to the right third molar region since a week which was radiating to the ear and the posterior part of the neck. Patient had no significant medical history and his vitals recorded were within normal. Submandibular lymph nodes were palpable single, mobile and were non tender. No pericoronal inflammation at 48 was noted. Blood and radiological investigations were done. Bleeding and Clotting times were normal. On radiological investigation (fig I) horizontal, position- A, class III impacted right lower third molar `with divergent roots were found. Mesial part of the crown of 48 was close to the inferior alveolar canal with around 1mm. A vertical, position- A, class I impacted 18 with the roots of the molar close to the sinus is noted. Based on these findings patient was posted for surgical extraction of 18 and 48 under local anaesthesia.

INTRA-OPERATIVE COMPLICATION AND MANAGEMENT

Bard Parker # 15 scalpel blade, a modified triangular flap with a releasing incision mesial to the second molar, posterior releasing was extended towards the anterior border of ramus of the mandible instead of towards the buccal mucosa was given, to expose the distal root which was close to the superior border of the mandible and the position of the crown. Full thickness mucoperiosteal flap was reflected and maintained by Austen's retractor; the lingual flap was also reflected and retracted by Howarth's retractor to prevent lingual nerve damage. Guttering was prepared by Lindeman stainless steel no.703 bur with a high speed straight hand piece with copious sterile saline irrigation.

In the process for a clear visual field, a high vacuum suction was used which was placed at the mesial incision area and at the lingual area. An air turbine hand peace was also used to section the crown which was inclined towards the buccal side of the tooth to avoid damage to the lingual nerve. The hand piece was immersed with in the flap that was not correctly held in place by the assistant surgeon. The air followed the freeway constituted by the partially destroyed fibres of the masseter muscle. During the procedure swelling was noted closed the patient's right eye. There was no pain, tenderness to palpation or difficulty in breathing as a result of swelling. Patient noted fullness sensation of the face and could not open the eye (fig II). The subcutaneous empyema was located in the latero cervical, cheek and orbital region, causing immediate closure of the eyelids. The procedure was stopped and 8 mg of dexamethasone together with 1.2 grams of amoxicillin and clavulanic acid was administered intra venous. Reductive manipulation was also carried out with digital pressures. After the control of the empyema, surgical procedure was carried out with a straight hand piece and irrigation with normal saline was done. The procedure was completed haemostatics achieved, and the wound was closed with 3-0 black braided silk suture. The patient was under observation for 2 hrs. Post-operative antibiotics, analgises and antipyretics along with enzymes were prescribed.

Follow up visits were scheduled on 2nd 3rd and 5th days (fig III day 5) on daily op basis. Swelling was minimal on the second day, and no signs of emphysema were noticeable on 5th day. Sutures were removed on 7th day. No further local / or systemic infectious complications occurred.

CASE REPORT 2

A 38 year's Caucasian male patient who had been attempted for surgical extraction of 38 by general dental practitioners (GDP) was referred to the department of oral and maxillofacial. Extended subcutaneous emphysema was noted, in the facial, peri-orbital, temporal, supra clavicular region of the left side (fig IV). There was no dyspnoea, respiratory sounds were normal. No visual loss occurred despite per orbital emphysema. Patient was managed by medically by 8 mg of dexamethasone together with 1.2 grams of amoxicillin, and clavulanic acid administered intra venous. Reductive manipulation was also carried out with digital pressures on an emergency basis. After the control of the emergency situation, careful examination of the surgical site was undertaken, radiological findings presented mesioangular, position C, class I type of impacted 38. The tooth

was displaced posteriorly with the roots of the tooth close to the inferior alveolar canal (fig V). A triangular incision was made, and at the time of guttering, a high speed airoter was used by the GDP. The protection of the flap was poor causing trauma to the elevated flap. It was also found that the lingual tissue was also reflected deeply to protect the lingual nerve. Swelling appeared after 5 minutes of guttering and the procedure was terminated and was shifted to our unit for management.

Patient recovery was uneventful with no complication such as pneumothorax or vision loss has occurred during the emergency stay and was discharged. He was recalled for review and further management after 3days was undertaken for the tooth removal under local anaesthesia.

DISCUSSION

Subcutaneous emphysema to be recognised and treated immediately. Subcutaneous emphysema in minor surgical cases is caused by the entrapment of air into the facial surfaces of the face and neck which results in distinction of overlying skin or mucosa causing panic to patients leading to emergency conditions intra operatively. Apart from clinical and radiological diagnosis, post surgical complications, intraoperative complications are to be considered and to be documented so that one can achieve the best treatment with minimum intra operative and postoperative complications. The most common intra operative complications documented are hematoma, bleeding, tissue injury, allergic reactions, angio oedema or emphysema [20] . Prolong intra operative time Causes facial swelling. High volume suctions at an air pressure of 4 kgf/cm [2] are commonly used for clear surgical area. This negative pressure can also cause entrapment of air within the surgical tissue plains causing emphysema. Palpations of the swollen areas with elicit crepitus or a Velcro sensation is the diagnostic character of emphysema [21] . According to Gamboabidal emphysema and hematoma are caused secondary to dental treatments. Mckenzie and Rosenber [22] reviewed [32] cases of subcutaneous emphysema 50% were due to the use of air driven hand piece 8 % of the cases reviewed had significant complications after subcutaneous emphysema, but our both the cases had none. Subcutaneous emphysema is not only intra operative complication of minor surgical procedures but also reported during restorative preparations, crown preparations and endodontic therapies [22] . Imait reported a case of emphysema during laser surgical procedures [23] . Kim etal. Described the spread of air into the tissue spaces, the most common route been dentoalveolar membrane or through the root canals when high pressures are used for isolation or for drying the canals during the endodontic procedures [3] . Elevation of large flaps increases the risk of emphysema during third molar surgeries which was the cause in both of the cases. Intermittent use of suctions or use of air driven hand pieces can diffuse the air into pterygomaxillary region further to the lateral pharyngeal space from the retromolar region. As the time for the surgery is prolonged and initial signs recognised this emphysema can dissect the visceral spaces penetrating into the cervical facial planes extending itself to the mediastinum which leads to life threatening consequences [24] . The presence of pain in the thorax and vertex region suggests the presence of mediastinum emphysema. A chest film is mandatory for diagnosis and the patient should be shifted to the emergency department for management. All the procedures to be stopped and the patient to be retrieved immediately. Extra oral pressure relieves the pressures within the tissues. Most of the cases resolve within 3-5 days. The normality can be achieved by 10 days [22] . Post-surgical instructions would prevent or avoid the increase of intraoral pressures by blowing the nose or playing the musical instruments [25].

According to smith and spencer [26] who classified the orbital infections by the complications arising from the surgical procedures into four groups. Our cases belong to group-I i.e. Inflammatory oedema alone without any cellulitis.

In the presented cases the air could have been forced into subcutaneous tissues during tooth sectioning with the high speed air turbine hand piece and the elevated flap could have provoked a valve effect as described in other clinical situations [27, 28] . Its progression and severity is limited by the facial planes and by the amount of air that has been introduced. Sometimes spread of large amounts of air into deeper spaces may cause more serious complications, including accumulation of air in the

retropharyngeal space, pneumo-mediastinum, pneumo-pericardium and peri-orbital. In our cases it was more an superior spread to the peri-orbital area than the inferior spread to peri-cardium.

CONCLUSION

Although the occurrence of the SCE is alarming, the condition is not dangerous. There is no specific therapeutic protocol recommended for its treatment. In mild to moderate cases, the treatment consists of observation and reassurance of the patient. In the vast majority of the cases emphysema improves within 2 to 3 days although residual swelling may be evident for up to 14 days. Cold compresses should be used to minimise swelling and improve circulation to the affected area. Broad spectrum antibiotic coverage is advice in all dental related cases since the introduction of the unsterile air from the airoter may include microorganisms.

But it is very important to know how to recognize this situation when occurs in order to treat the patient appropriately. The appropriate therapy is determined by its aetiology. Though knowledge of the diagnostic clues is important for early recognition and initiation of treatment which is essential to prevent possible complications.

1. Prevention of emphysema requires adherence to well adapted surgical procedures.
2. Minimal elevation of mucoperiosteal flaps.
3. Prevention of lingual tissue elevations or retractions, muscular attachments should be preserved.
4. Firm and gentle retractions of mucoperiosteal flaps.
5. Avoid air turbine high speed hand pieces.
6. Prompt diagnosis and intervention is important to avoid life threatening consequences.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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