Subcutaneous Emphysema and Pneumomediastinum during Extraction of Maxillary Third Molar: A Case Report

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Subcutaneous emphysema and pneumomediastinum is a relatively uncommon phenomenon. It may occur secondary to dental treatment using high-speed air turbine handpieces, especially after extraction of tooth. Subcutaneous emphysema is often limited only to the areas of head and neck, but also can involve deeper structures. Thorough examination and conservative treatment of these problems are essential in preventing life-threatening complications such as airway obstruction and mediastinitis. The subject of this report is a 57-year-old woman with subcutaneous emphysema and pneumomediastinum during the extraction of maxillary third molar using high-speed air turbine handpiece. If there isn’t any appropriate measure, severe complications may occur. Therefore it is important to be well-informed of proper diagnosis and treatment. This article shall present a case report with literature review.

Key Words: Mediastinal emphysema; Subcutaneous emphysema; Tooth extraction

Introduction

Subcutaneous emphysema and pneumomediastinum occurring on the face and neck area can be caused by neck dissection, adenotonsillectomy, mandibular fractures, or the use of high-speed air turbine handpieces during dental treatment. As swelling caused by the inflow of air through the gap of connective tissues, subcutaneous emphysema can cause elevation of skin tissue, soft tissue edema and crepitus during palpation. In severe cases, the patient complains of dyspnea or chest pain. In this case, the inflow of air into the lung or mediastinum should be suspected. The occurrence during dental treatment is rare, but if so, it is known to occur during root canal treatment, external injuries...
treatment or extraction of maxillary and mandibular teeth, the 3rd molar in particular\textsuperscript{3,4}.

Especially, pneumomediastinum occurs when the air leaks out from the lung into mediastinum, and it can cause fatal complications such as dyspnea caused by mediastinitis or pneumothorax\textsuperscript{5}.

It is known that prognosis of subcutaneous emphysema and pneumomediastinum developed after tooth extraction is appropriate when correct early diagnosis and appropriate measures are taken. Therefore, this report assumes that the consideration of this is critical. However, although there are some case reports about subcutaneous emphysema occurred after the extraction of the mandibular 3rd molar, it is hard to find case reports about extensive subcutaneous emphysema and pneumomediastinum occurred during the extraction of the maxillary 3rd molar. For this reason, this report features its clinical diagnosis and treatment method with literature reviews.

Case Report

A female patient, aged 57 years, visited the hospital as an outpatient when she suddenly felt her face and neck swollen, and had trouble breathing when she had received extraction of the right maxillary third molar using high-speed air turbine handpiece in a private dental practice. It seemed that the above phenomena had occurred during resection of crown after flap elevation (Fig. 1). In the blood test results, there was a slight inflammatory response with white blood cell 12,130/μl, seg-neutrophils 83.5%, C-reactive protein 15 mg/L, and erythrocyte sedimentation rate 42 mm/h, and there were unusual features as a result of uroscopy, liver function test, renal function test and electrocardiogram. Although the subject was taking medicine for anamnesis of thyroid cancer, she had no past medical history such as high blood pressure, diabetes, hepatitis or tuberculosis, and no medication related to these and drug hypersensitivity reaction. There was an overall edema in right face including periorbital region, neck area and upper chest, and there was

Fig. 1. Panoramic view (initial examination) (arrow).

Fig. 2. (A) Chest posterior-anterial shows pneumomediastinum, subcutaneous emphysema in the neck area (arrow). (B) Magnified image (arrow).
crepitus during palpation. The subject complained of continuous dyspnea and chest pain, and the authors of this report could observe extensive subcutaneous emphysema in submandibular space, buccal space, masticatory space, parapharyngeal space and the neck area, and pneumomediastinum on the chest through chest radiograph and dental computed tomography (CT) (Figs. 2, 3).

Therefore, the authors of this report diagnosed the symptoms as subcutaneous emphysema and pneumomediastinum caused by high-speed air turbine handpiece, and hospitalized the subject to perform conservative treatment such as penicillin antibiotics injection to prevent secondary infection and oxygen feeding through nasal cavity. Despite the measures taken, the subject complained of continuous chest discomfort and breathing trouble, a CT scan on the 7th day of hospitalization was performed. Over the process, subcutaneous emphysema had been reduced, but submandibular space, buccal space, masticatory space, parapharyngeal space and neck area continued to display the symptoms (Fig. 4). A cooperative treatment with cardiology and pulmonology was performed, and no unusual features were observed. The subject was discharged from the hospital without any complications on the 8th day of hospitalization.
Discussion

Turnbull first reported the case of subcutaneous emphysema occurred after extraction of tooth of a trumpeter in 1900, and Shovelton reported the following 4 cases which can be the causes of subcutaneous emphysema: actions of patient to rise intra-oral pressure, use of compressed air during surgery, difficult and long lasting surgery, case with no reason.

Minton and Tu reported subcutaneous emphysema occurred after fracture, and Afzali et al. reported subcutaneous emphysema and pneumomediastinum occurred after extraction of the mandibular second molar.

Subcutaneous emphysema can be diagnosed with symptoms of edema, sudden swelling on the neck, and crepitus during palpation on the neck area, and it is confirmed through CT of face and neck area as well as general neck and chest radiography. Also voice change of the subject, dyspnea, chest and back pain, subcutaneous emphysema through chest radiography, and electrocardiogram change at 25% were identified as diagnostic features of pneumomediastinum. The most distinctive auscultating feature is Hamman’s sign, which is a rustling sound heard during systole. In some cases, pneumomediastinum causes the rise of central venous pressure, hypoventilation, low blood pressure, and hypoxia, which require emergency medical treatment, due to the rise of venous pressure, brain pressure and airway pressure by pressing the breast wall and blood vessels.

In this case, there was a sudden swelling of face and neck area during extraction of the maxillary third molar, subcutaneous emphysema and pneumomediastinum were diagnosed through CT and chest radiography. There was also a crepitus during palpation.

The maxillary molar is connected with buccal space and infratemporal space and flows into secondary spaces such as masseteric space, temporal space, and pterygomandibular space through parapharyngeal space. Also, parapharyngeal space is connected to paravisceral space at both sides and visceral space, retropharyngeal space, vascular space and pretracheal space in the neck area are connected to mediastinum of chest. Therefore, a high pressure air emitted from a dental high-speed air turbine handpiece can go through the primary and secondary spaces and reach mediastinum of the chest causing subcutaneous emphysema and pneumomediastinum. In this case, pneumomediastinum is regarded to have occurred through facial space. As this is the same as the spread way of odontogenic infection, which causes fatal complications such as mediastinitis, special attention should be paid.

When there is a swelling on the face and neck area, it should be discerned from vasogenic edema caused by cellulitis, angioedema or allergic reaction. As local edema caused by hemotelyangiosis or vasogenic edema features a huge whealn (a swollen rash from hives), but subcutaneous emphysema and pneumomediastinum can be distinguished from other diseases through sudden severe swelling without unusual tenderness, crepitus during palpation, accompanying of high fever, white blood cell number increase and Hamman’s sign which a rustling sound heard during systole.

In this case, crepitus observed through physical examination has a big diagnostic significance as failure to recognize this symptom can be a clinical sign that can be misdiagnosed as an allergic reaction which can cause the delay of treatment and complications.

Subcutaneous emphysema and pneumomediastinum is known as the disease cured naturally without serious complications. Although it shows difference depending on the experience and disease seriousness of patient, most of them are recovered in one or two days, and completely cured in 10~14 days. Most of them are cured with conservative treatment, and it is important to have the patient...
receive emergency endotracheal intubation when dyspnea and edema are developed which explain the expected progress of the disease. Also, hospitalization is required in principle when there is a possibility of invasion into mediastinum and dyspnea. Although surgery is not considered because it can cause spread of subcutaneous emphysema, when the drainage of infected tissue is needed, it can be removed through surgery[14]. There are pressing of the involved area, insertion of needle, and several incisions and drainage and vent formation as invasive treatment. However, recent treatments such as surgical decompression have no effect[15]. Also, when emphysema is severe, tracheotomy or endotracheal intubation need to be performed, but the subcutaneous emphysema and pneumomediastinum through dental high-speed air turbine handpiece has usually good prognosis, performing tracheotomy is very rare.

Overall, 100% oxygen feeding can reduce the elapse of disease. This reduces subcutaneous air by substituting it with oxygen in tissues and increases absorption of nitrogen which speeds up absorption in tissues by reducing nitrogen partial pressure around tissues. The infection can also be developed through the inflow of air into mediastinum, and this can cause fatal complications such as mediastinitis. Therefore, preventive antibiotic therapy should be used. As an antibiotic, both aerobic and anaerobic medicine should be selected to prevent air infection in tissues at early stage and the antibiotic which is effective to the patient should be selected through microbial sensitivity test. Through this procedure, taking higher-than-normal dose of antibiotic and regulation of blood glucose through thorough examination for diabetes together is very helpful[16].

In this case, authors of this report administered 3 L/min 100% oxygen and antibiotics of amoxicillin+clavulanic acid which is effective not only for intra-oral resident bacteria but also for pseudomonas aeruginosa, an anaerobic bacteria which causes infection. One week after hospitalization, slight subcutaneous emphysema was found on facial space through neck CT. However, the patient was discharged from the hospital as there were no unusual features in the cardiology and pulmonology examination results, and the subject’s discomfort disappeared.

As complications of subcutaneous emphysema and pneumomediastinum, tension pneumothorax, pneumoperitoneum, or decline of cardiac function can occur[17], fatal aeroembolism and mediastinitis have been reported[18].

When there is an increase of subcutaneous emphysema and the lung does not expand, bronchoscopy inspection for diagnosis can be performed to exclude airway rupture. If there is a pneumothorax, closed thoracostomy should be performed and the respirator shall be removed. If it cannot be removed, the maximum airway pressure should be reduced or the progress of subcutaneous emphysema should be prevented through adjustments to the inspiratory and expiratory time ratio[16].

During dental treatments using high-speed air turbine handpieces such as treatment for trauma, root canal therapy or tooth extraction, subcutaneous emphysema and pneumomediastinum can occur, however, it is not very common. Therefore, dentists should be aware of its risk of complications and perform a detailed medical examination, medical history hearing and careful, conservative treatment to prevent complications. To prevent subcutaneous emphysema, minimum flap elevation and use of appropriate tool are needed for tooth extraction. In particular, careful attention should be paid when high-speed air turbine handpiece is used. When subcutaneous emphysema occurs, the dentists should explain the risk of complications that can occur to the patient, administer antibiotics and supply oxygen. After that, careful observation is required.

During dental treatment, in many cases, subcutaneous emphysema occurs after the mandibular third molar was extracted, and there have been
many cases reported in Korea where it occurred after tooth extraction. However, there are few cases where subcutaneous emphysema occurred after extraction of the maxillary third molar has developed to pneumomediastinum, and such cases were poorly reported. Therefore, this report features its anatomical structure, pathogenesis, possible symptoms, diagnosis and complications, as well as treatment method with literature reviews.

Conflict of Interest

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

References