Air entrapment in the cervicofacial region due to injury

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Air entrapment in the soft tissues of the cervicofacial region is a benign entity occasionally developing after a fracture of the facial bones or ribs. Characteristic clinical findings of air entrapment are the sudden onset of edema and palpable crepitation of the respective region. Possible complications are respiratory obstruction or contamination of the mediastinum. Treatment includes precautionary administration of antibiotics. In regard to the region of injury, air may enter the anterior cranial fossa where it compresses the brain, resulting in pneumocephalus, which may cause meningitis as an imminent complication. After a fracture at the zygomatic or nasal bones, subcutaneous emphysema may result in the middle third of the face. It is also possible for air to penetrate into the retrobulbar fat and damage the eye. In other cases, air traverses the parapharyngeal space and causes pneumomediastinum. Moreover, after a fracture at the mandible, it is possible that air passes through the floor of the mouth and the submandibular area to the deep tissue layers again causing pneumomediastinum. Alternatively, after rib fracture, air could follow an upward course, resulting in subcutaneous emphysema of the thoracocervicofacial region. In this article, patients who suffered from air entrapment were categorized into four groups, and the methods used to diagnose and treat these patients are presented. (Quintessence Int 2004:35:307–311)

Key words: maxillofacial injury, pneumocephalus, pneumomediastinum, retrobulbar area, rib fracture, subcutaneous emphysema

When air or gas penetrates and gets trapped in the soft tissues of the face after a disruption of the continuity of the mucous membranes or the bones, a benign entity arises. Occasionally, if the appropriate treatment is not applied, there is a possibility of invasion of the air into the surrounding tissues. This entity is mainly developed at the cervicofacial region after either a trauma to the face, even a minor one, or after certain dental operations (tooth extraction, endodontic treatment). Air is forced into deeper tissue layers if under negative pressure, as occurs with coughing, vomiting, sneezing, nose blowing, or air-syringe or air-turbine drill usage.

Characteristic clinical findings of air entrapment in the face are associated with the sudden onset of edema and palpable crepitation, which are sometimes concomitant with pain. The absorption of air takes place gradually within 2 weeks. Preventive treatment with antibiotics is recommended in order to avoid contamination of the entrapped air. In the case of nonautomatic absorption, it is possible that the air compresses the adjacent tissues, causing damage. It is even possible that the air dissecting via the fascial planes may cause damage to distant structures, such as the chest.

Sometimes, however, air may enter the soft tissues of the chest after an injury to the ribs or after surgical procedures at the respiratory or gastrointestinal tract. Following the reverse course, the air could result in the characteristic clinical appearance of cervicofacial-region subcutaneous emphysema.
Fig 1 Air entrapment in the anterior cranial fossa in the lateral skull radiograph (arrow left) and the CT scan (right).

METHOD AND MATERIALS

A small percentage of patients treated in the Department of Oral and Maxillofacial Surgery, Hospital "KAT" Athens, Greece, developed air entrapment in the soft tissues of the cervicofacial region after bone fractures. These cases have been categorized with reference to the location of air entrance. The mechanism of entrance, diagnostic procedure, possible complications for each category, and treatments are presented.

In the first category, which concerned the frontal region, the diagnosis was made by radiographic examination of the skull and computerized tomography (CT). In the second category, which concerned the zygomatic and maxillary region, computerized tomography was sufficient to make the diagnosis. In the third category, which included the mandible and cervix, diagnosis was made taking into account the clinical and radiographic appearance of the cervical spine. Finally, a fourth category, which concerned the chest, was diagnosed by radiographic examination.

Antibiotics were administered to all patients. In the third category, a wound was also sutured.

RESULTS

After administration of antibiotics, each patient was restored to health without further complications.

DISCUSSION

In the first category, air entered the anterior cranial fossa after a fracture at the nasoethmoidal complex or after Le Fort III fractures, through the frontal sinus wall or the ethmoidal cells. The air, after penetrating the dura and arachnoid meninges, reached the subarachnoid space where brain compression caused the pneumocephalus. Diagnosis was achieved by lateral skull radiographic examination and CT of the brain (Fig 1). Administration of antibiotics, which resolved the blood-brain barrier, prevented probable contamination of the cerebrospinal fluid and intracranial expansion of air.

In the second category, fractures of the nasal bones or the upper maxillary sinus wall permitted air passage into the soft tissues of the eyelids (Fig 2), the cheeks (Fig 3), and retrobulbar (Fig 4), resulting in subcutaneous emphysema. In the middle third of the face, subcutaneous emphysema was reported after Le Fort I osteotomy, dacryocystorhinostomy, and maxillary molar tooth extraction. Subcutaneous emphysema was diagnosed by the characteristic clinical findings at the eyelids and the cheeks, while just only the computerized tomography revealed retrobulbar air. Treatment with antibiotics contributed to the avoidance of periorbital emphysema infection due to respiratory tract bacteria, which may convert the emphysema into periorbital cellulitis and necrotizing fasciitis. Moreover, the air accumulation in the retrobulbar region may compress the soft tissues and the eyeball, resulting in a decrease of visual acuity, pupillary reflex, eyeball mobility, or even blockage of circulation to the retina, which could lead to loss of vision. In such a case, decompression of the eyeball is required by means of lateral canthotomy or air aspiration.

In another case, the subcutaneous emphysema of the middle third of the face spread to the pterygo-
Fig 2 Subcutaneous emphysema of the left lower eyelid following fracture of the infraorbital rim (left), and CT scan showing air in the left periorbital area (arrows) (right).

Fig 3 Subcutaneous emphysema of the middle third of the face shown clinically (left) and in the CT scan (right).

Fig 4 CT scan revealing air in the retrobulbar area (arrow).
mandibular-parapharyngeal-retropharyngeal space, and via the cervicothoracic compartment, caused the pneumomediastinum.8,9,12

In the third category, air entered through a fracture of the mandible and disrupted the continuity of the periosteum. The air was then forced to the submandibular-sublingual and cervical space, up to the supraclavicular fossa.4,5,11,13 Diagnosis relied on the clinical appearance of the cervix (Fig 5a)1,8,15 and was confirmed with the lateral cervical radiograph, on which multiple pathognomonic radiolucent areas in the soft tissues were seen (Fig 5b).1,3,15

The immediate reduction of the fracture and the suture of the mucoperiosteum as well as the administration of antibiotics prevented recrudescence, such as swallowing or breathing difficulty and the spread of air through the peritoneal spaces to the mediastinum.5

Regarding the fourth category, air spread into the cervical soft tissues because of rib fractures. Ascending via the perivascular spaces, the air caused extensive subcutaneous thoracocervicofacial emphysema. The diagnosis was immediate using clinical examination and conventional chest radiographic examination (Fig 6).14 Antibiotics contributed to the avoidance of the respiratory obstruction and contamination of the mediastinum.15

CONCLUSION

Air entrapment in the cervicofacial region of an injured patient must be included in the clinical evaluation and must be treated carefully, so as to avoid severe complications.
REFERENCES


