

Extensive Subcutaneous Emphysema Following Paranasal Sinus Fractures

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A 41-year-old man was brought by ambulance to the emergency department following a motor vehicle collision. His car skidded into a road divider when he attempted to avoid cattle crossing the roadway. Because he was not wearing a seat belt, his face and chest struck the steering wheel. He sustained bleeding and swelling across his face and nose. In the emergency department, he was alert and oriented, with a Glasgow Coma Scale score of 15, and his vital signs were stable. Examination revealed extensive bilateral periorbital and right facial swelling associated with palpable crepitus and ecchymosis, extending inferiorly toward the right side of the neck and clavicle (**Figure 1**). A computed tomography (CT) scan was performed, and reconstructed images confirmed the suspected facial injury.

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Le Fort II fracture with subcutaneous emphysema and pneumomediastinum

The CT scan showed that the patient had sustained fractures of the facial bones, consistent with a Le Fort II fracture, complicated by extensive subcutaneous emphysema involving the bilateral periorbital regions, the right side of the face, and the neck, as well as pneumomediastinum (**Figure 2**). The reconstructed CT images of the skull clearly depicted the fracture trajectories (**Figure 3**).

Among the most critical and complex paranasal sinus fractures are those known as Le Fort fractures, which describe predictable patterns of maxillary disruption that are classified into three main types (**Figure 4**), based on fracture lines originally described by René Le Fort. A Le Fort II (pyramidal) fracture typically extends from the nasal bridge (nasofrontal suture) down through the medial orbital walls, across the infra-orbital rims, and along the zygomaticomaxillary sutures, resulting in the isolation of a pyramidal segment that includes the nose and central midface. Although uncommon, subcutaneous emphysema may arise from direct trauma to the maxillary sinus, the naso-orbital-ethmoidal complex, or zygomaticomaxillary complex fractures that involve the lateral wall of the maxillary sinus. Such fractures can create a communication between the air-filled sinus system and adjacent soft-tissue spaces—namely the orbit, the eyelids, and the subcutaneous tissues of the face.¹

In our case, the paranasal sinus fracture resulted in air infiltration into adjacent soft tissues via disruption of the maxillary sinus mucosa. Once introduced into the facial compartments, the air may disseminate through several anatomical channels. It can extend posteriorly

into the infratemporal fossa and superiorly into the pterygopalatine space or through the inferior orbital fissure, thereby leading to orbital emphysema.² After entering the infratemporal fossa, the air migrates inferiorly into the buccal and pterygomandibular spaces, then progresses into the submandibular space, finally reaching the parapharyngeal space. From here, air may track posterolaterally toward the carotid sheath, or posteromedially toward the retropharyngeal space, ultimately resulting in pneumomediastinum, as observed in this case.³

Subcutaneous emphysema typically develops following mid-facial (paranasal sinus) fractures, when a transient post-traumatic window permits air to infiltrate into the subcutaneous tissues. Thereafter, the escape routes often become sealed by blood clots—both within the sinus cavities and at the fracture margins—preventing further air egress.¹

On physical examination, the most common findings associated with subcutaneous emphysema are swelling and crepitus on palpation. A cohort study of 390 paranasal sinus fracture cases by Brasileiro *et al.* found that clinical manifestations of orbital emphysema, such as subcutaneous crepitation and oedema, were seen in only 7.4% of cases.¹ Other than that, subcutaneous emphysema of the periorbital and neck region may present with palpebral closure, resulting in visual distortion and phonation changes from vocal cord compression.⁴

Subcutaneous emphysema can be elicited as regions of radiolucency on the radiograph. In conjunction with x-ray imaging, CT scans can reveal areas of reduced radiodensity within the subcutaneous layer, indicating



Figure 2: a) Axial view of plain CT scan of the head showing comminuted fractures of bilateral maxillary sinus wall, bilateral lamina papyracea, and bilateral pterygoid bones and subcutaneous emphysema at bilateral maxillary region. b) Coronal view of plain CT scan of the neck showing subcutaneous emphysema at right parotid, visceral, and right posterior cervical spaces. c) Axial view of plain thorax CT showing minimal pneumomediastinum.

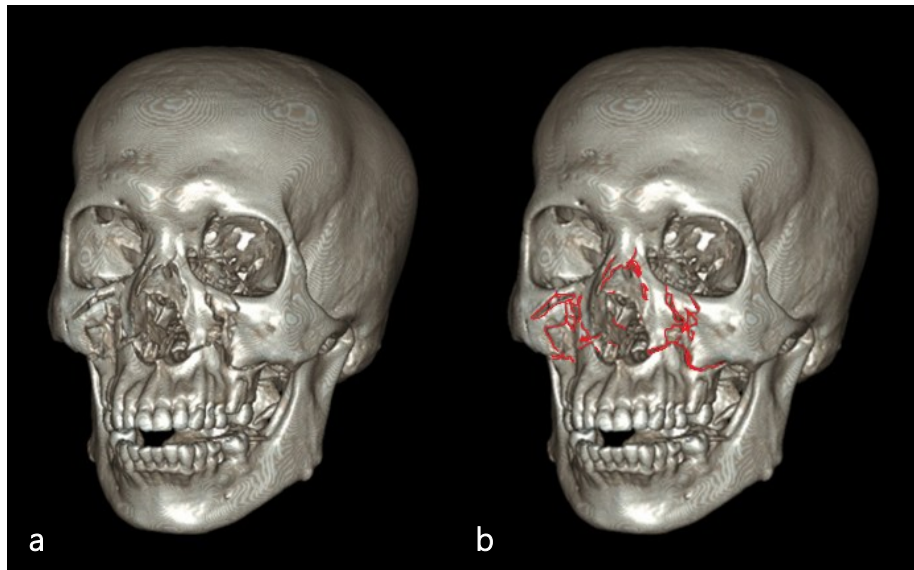


Figure 3: a) Reconstructed CT scan 3-dimensional view of the patient's skull, and b) fractures as shown by red markings.

the presence of gas. CT has the potential to exhibit a higher level of sensitivity in detecting the origin of injury responsible for subcutaneous emphysema, which may not be discernible on an anteroposterior or lateral xray.⁴

Management of extensive subcutaneous emphysema may include bed rest and sedation, restriction of oral intake, and administration of cough suppressants and stool softeners. In certain cases, physicians may opt to administer broad-spectrum antibiotics prophylactically. If a mucosal rupture is evident, it may be necessary to suture the torn mucosa — an intervention designed to prevent secondary infection of subcutaneous tissues and further spread of emphysema.⁵ It is also necessary—especially after hospital discharge—to advise patients to refrain from activities that raise intranasal pressure, such as sneezing, nose-blowing, diving, or flying.⁶

Last but not least, in cases of extensive traumatic subcutaneous emphysema of the head and neck, the attending clinician should assess for further extension—superiorly into the periorbital region and inferiorly into the mediastinum. Such cases also demand a multidisciplinary approach and a thorough evaluation of the eyes, neck, and thorax.

Abbreviation

CT Computed tomography

Declarations

Conflict of interests

The authors declare no conflict of interests.

Patient Consent

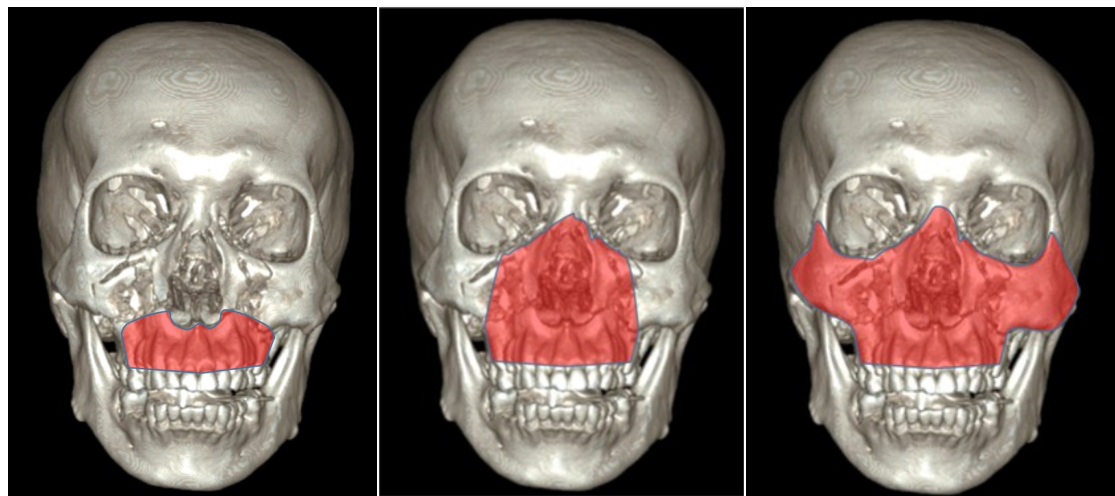
Patient consent has been obtained.

Acknowledgement

None

References

1. Brasileiro BF, Cortez AL, Asprino L, Passeri LA, De Moraes M, Mazzonetto R, Moreira RW. Traumatic subcutaneous emphysema of the face associated with paranasal sinus fractures: a prospective study. *J Oral Maxillofac Surg*. 2005;63:1080-7.
2. Makrides H, Lawton LD. Don't Blow It! Extensive Subcutaneous Emphysema of the Neck Caused by Isolated Facial Injuries: A Case Report and Review of the Literature. *J Emerg Med*. 2017;52:e57-e59.
3. Bars N, Atlay Y, Tülay E, Tanju G. Extensive subcutaneous emphysema and pneumomediastinum associated with blowout fracture of the medial orbital wall. *J Trauma*. 2008;64:1366-9.
4. Kukuruzza K, Aboeed A. Subcutaneous Emphysema. [Updated 2023 Jul 17]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK542192/>
5. Bizaki, A., Kääriäinen, J., Harju, T. et al. Facial subcutaneous emphysema after tonsillectomy. *Head Face Med* 10, 11 (2014). <https://doi.org/10.1186/1746-160X-10-11>
6. Adam J. Rosh, Rahul Sharma, Orbital Emphysema After Nose Blowing, *The Journal of Emergency Medicine*, Volume 34, Issue 3, 2008, Pages 327-329, ISSN 0736-4679, <https://doi.org/10.1016/j.jemermed.2007.05.030>.



Le Fort I

Le Fort II

Le Fort III

Figure 4: Le Fort fractures classifications highlighted in red.