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CASE REPORT

Craniofacial/Pediatric

An Elegant, Simple Solution to a Newly Described Phenomenon: Traumatic Nasomalar "Ball-valve" Fistula

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Summary: Sequela of complex craniomaxillofacial trauma is common. We report a previously undocumented, highly unusual, postfacial trauma presentation of a "nasomalar ball-valve fistula." The clinical presentation was a sharp influx of air into the left malar subcutaneous space with each nasal inspiration, followed by near-complete deflation upon each expiration. We also report a very simple and elegant solution of using a nasal trumpet to completely resolve this problem without the need for additional operation. The final recovery was uneventful. We hope to make all facial surgeons aware of this diagnosis and to remind them to keep this simple device in their armamentarium to address similar issues. *(Plast Reconstr Surg Glob Open 2022;10:e4312; doi: 10.1097/GOX.0000000000004312; Published online 11 May 2022.)*

Subcutaneous emphysema (SE) of the face is caused by the introduction of air into the fascial connective tissue planes. Any condition where the mucosa is interrupted, accompanied by increased airway nasal/oral pressure, may lead to accumulation of air within the soft tissues.[1] Crepitation, on palpation, is almost pathognomonic for SE.[1]

The known etiology of SE includes soft tissue injury during dental operations, endodontic treatment, use of continuous positive airway pressure, ventilation with endotracheal intubation for general anesthesia, status post mandible and maxillary surgery, and secondary to facial injuries.[1] SE following a facial fracture was first reported in the literature in 1958 by Stockdale.[2]

In the present case, we describe a posttraumatic patient with malar subcutaneous air, which expanded with inspiration through nose and decompressed with expiration. We have anatomically named it a "nasomalar ball-valve fistula." The ball valve effect is a partial obstruction that allows an inflow of air during the inspiration phase of breathing but prevents or limits outflow as expiration begins. This results in trapping of the air with a concomitant buildup of pressure and is classically seen where tissue is tethered to a wall or lumen.[3,4] To the best of our knowledge, this is the first such case reported in the English literature.

CASE PRESENTATION

A 31-year-old man presented to the emergency department, with status post alleged assault. He did not lose consciousness but presented with periorbital edema, ecchymosis, midface tenderness, and facial deformity. Computerized tomography scan revealed bilateral displaced naso-orbital-ethmoidal (NOE) complex fractures, complex bilateral maxillary sinus fracture, bilateral orbital floor fracture, and bilateral pterygoid plate fractures (Fig. 1). The patient underwent open reduction and internal fixation of the bilateral zygomaticomaxillary complex, and bilateral NOE complex fractures.

The immediate postoperative clinical examination revealed an air fistula between the left nasal passageway and the left cheek. With each inhalation, the left cheek was noted to inflate with air, followed by near-complete deflation upon exhalation. (**See Video 1 [online],** which displays the postoperative clinical examination revealing an air fistula between the left nasal passageway and the left cheek. Please note with each inhalation, the left cheek inflated with air, followed by near-complete deflation upon exhalation.) There was no accumulation of air in the soft tissue and no crepitation on palpation. All surgical incisions (left subciliary, left upper buccal sulcus

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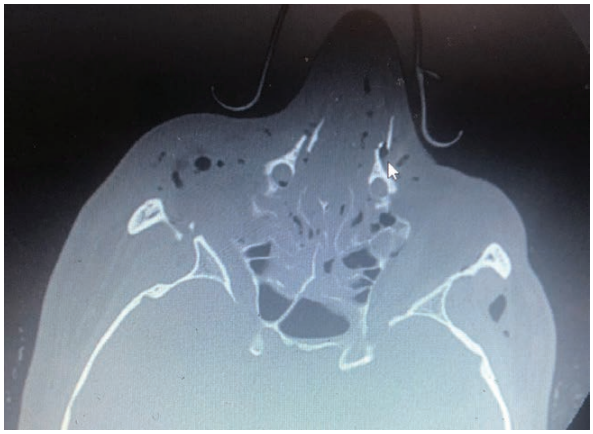

Fig. 1. Posttraumatic maxillofacial computerized tomography scan axial image demonstrating bilateral NOE and facial fractures. Note the air diffusing across the left nasal passageway to the left cheek (white arrow). This is the potential inflow site for nasomalar fistula.

and gullwing glabella) were intact. The complex, comminuted fracture of the glabella and left NOE with soft tissue damage was deemed the potential entry point of air. The clinical diagnosis of an "air fistula" between the left nasal airway and the left cheek was made.

We decided to insert a 7.0 mm/30 FR nasal trumpet through the left nasal cavity in hopes of bypassing the fistula and redirecting air. Interestingly, as soon as the nasal trumpet was inserted, the problem resolved, proving the hypothesis of a communication between the left nasal airway and left cheek. (**See Video 2 [online],** which shows that with insertion of a 7.0 mm/30 FR nasal trumpet through left nares, the fistula was bypassed, and the problem was resolved, proving the hypothesis of a communication between the left nasal airway and the left cheek.) The next day, there was no proptosis and breathing was comfortable. There was no significant left cheek movement with breathing. Our postoperative instructions included sneezing and coughing with the mouth open, avoiding blowing or whistling, and avoiding the Valsalva maneuver.

The patient was discharged and seen in the office 2 weeks later. At that time, all incisions were healing well, and the nasal trumpet was removed. There was good breathing through both nostrils and complete resolution of the fistula. The patient was seen 4 months later, and he was satisfied with his recovery. All areas were healing very well with no clinical evidence of persistent left nasomalar air fistula. (**See Video 3 [online],** which shows that the patient at 4 months postoperative examination revealed no clinical evidence of persistent left nasomalar air fistula.)

DISCUSSION

A nasopharyngeal airway, also called a nasal trumpet, was introduced by Hans Karl Wendl in 1958[5] (Fig. 2). This inexpensive, flared ended, easily available, semirigid plastic device allows the air to flow freely through its patent

Fig. 2. Nasal trumpet.

openings. It has found its importance in emergency resuscitation, anesthesia, and maintaining nares openings for patients with facial burns.[6]

The common uses include relief of upper-airway obstruction after extubation in a spontaneously breathing patient, or during mask ventilation when an oral airway (and jaw lift) has failed to protect the airway.[6] They may also be used by first responders and emergency personnel in airway management.[7]

The nasal trumpet may be used for treatment of some adults with moderate-to-severe obstructive sleep apnea syndrome.[8] It has also been used as a short-term treatment of obstructive sleep apnea syndrome in children with syndromic craniosynostosis and Pierre Robin syndrome.[8]

The commonly reported side effects of nasal trumpet use include poor patient tolerance, nasal mucosal/pharyngeal irritation causing pain or bleeding, and nasopharyngeal incompetence with nasal regurgitation. There are also reports of nasal ulcers or infections such as sinusitis from intubations with a nasal trumpet, none of which are experienced by our patient.[9]

Our patient was unique in the sense that there was inflation of malar skin on nasal inspiration and near-complete deflation on expiration. There was no crepitation on our examination. This is consistent with a "ball-valve" description.[3,4] Our hypothetical diagnosis was traumatic breached ipsilateral nasal mucosa, mucoperichondrial, and periosteum as the potential source of air inflow. It is likely that the increase in intranasal pressure during anesthesia allowed the air to travel to the subcutaneous tissue via the mucoperiosteal opening created by trauma. Roccia et al explained that the increasing pressure inside the upper airways can force the air into the surrounding loose connective tissues. Thus, the air takes the path of least resistance through trauma-induced mucoperiosteal tears.[10]

Therefore, it is possible that a combination of trauma and general anesthesia caused this problem. We have described this problem as a "nasomalar ball-valve fistula" due to the clinical communication between the nasal airflow and the ipsilateral cheek communication. Notably,

the immediate relief and long-term solution to this problem was provided by a simple nasal trumpet.

A detailed literature search on National Library of Medicine, Medline, Cochrane Review, and Google Scholar databases did not reveal any articles in English literature on a nasomalar fistula.

Further studies are needed to shed additional light on this newly described phenomenon. Also, this is a reminder to all facial surgeons to keep the nasal trumpet in their treatment armamentarium, as a simple, elegant solution to such problems.

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PATIENT CONSENT

The patient provided written consent for the use of his image.

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