

## Aerospace Medicine Clinic

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It is a snowy winter day and you're the flight surgeon for a fighter squadron at an operational northern air base. The flight clinic is quiet, as there is an intersquadron hockey game occurring at the base arena. You receive a phone call that an ambulance is bringing a hockey player from the ice arena to the clinic for further assessment.

You meet the ambulance crew upon arrival and receive a report that the player was hit in the face with a hockey puck. You direct the crew to an acute treatment area for assessment. The patient is wearing full protective hockey equipment but is alert, responsive, and in no acute distress. They are holding blood-soaked gauze over their nose with two hands.

The patient is a 27-yr-old fighter pilot who received direct blunt trauma to the nasal bridge from a puck while defending their team's net. They deny any additional trauma, loss of consciousness, or additional symptoms of concussion. They have no nausea, diplopia, vertigo, or malocclusion. Their vital signs are stable.

1. Initial physical examination of the nose is important to rule out which of the following conditions that require prompt diagnosis and treatment?
  - A. Epistaxis.
  - B. Septal deviation.
  - C. Septal hematoma.
  - D. Blowout fracture.
  - E. Nasal fracture.

### ANSWER/DISCUSSION

**1. C.** It is essential to recognize a septal hematoma so it can be treated to reduce short- and long-term sequelae. Septal hematomas are often bilateral and are typically observed as bulging red or ecchymotic fullness along the anterior section of the septum. The hematoma occurs between the septal cartilage and the perichondrium, which disrupts the blood supply to the underlying cartilage. Therefore, untreated septal hematomas can lead to subsequent septal distortion, septal abscesses, and complete necrosis with a saddle nasal deformity.<sup>10</sup> Although the aircrew had no diplopia or other ophthalmological symptoms, flight surgeons

should recognize a blowout fracture involving the medial orbital rim. These fractures can disrupt the medial canthal ligament, impair the lacrimal duct, and result in enophthalmos and diplopia.<sup>6</sup> Additionally, patients with septal hematomas, cerebrospinal fluid rhinorrhea, malocclusion, or extraocular movement defects should promptly be referred to a subspecialist.

You perform a systematic external and internal physical exam of the maxillofacial structures.<sup>12</sup> On the external examination you observe a 2-cm horizontal laceration to the nasal bridge, bilateral epistaxis, and peri-nasal edema. You also palpate some crepitus of the nasal bones. Although difficult without a rigid nasal endoscope, the internal examination reveals a slightly deviated septum, lacerated mucosa, but no pale septal mucosa or purple septal masses bilaterally.<sup>7</sup> The most significant clinical criteria for a nasal fracture from a multivariate analysis were determined to be epistaxis, ecchymosis, inflammation, and acute septal injury.<sup>12</sup> Based on the clinical history and physical examination, you diagnosis an acute lateral-type nasal fracture.

2. Which of the following imaging methods is most beneficial for guiding further clinical management?
  - A. Plain radiographs.
  - B. Ultrasonography.
  - C. High-resolution computed tomography (CT).
  - D. Clinical examination.
  - E. Magnetic resonance imaging.

### ANSWER/DISCUSSION

**2. D.** An early clinical examination, or after the edema has resolved, is typically adequate to reveal any deformities. Although plain radiographs are standard imaging procedures, they are not routinely indicated for the management of nasal fractures due to a high false positive rate, inability to distinguish previous fractures, and because they infrequently change management.<sup>9,10</sup> High-resolution CT can be a beneficial imaging

method to further guide clinical management of nasal fractures and maxillofacial trauma. CT imaging allows for the evaluation of concomitant injuries, determination of the spatial alignment of fracture fragments, and evaluation of the bony septum.<sup>8</sup> Ultrasonography has been examined as an additional imaging technique for diagnosing nasal fractures, has been reported to have similar sensitivity and specificity as CT, and can result in prompt diagnosis and management by emergency department clinicians.<sup>4</sup> In particular, lateral ultrasonography is useful for recognizing disruptions in bone continuity and displacement of fracture segments.<sup>1</sup> It is important to recognize the operator-dependent limitations of this modality.

You discuss the clinical case with the on-call otolaryngologist, who is 3 h away and agrees to see the patient in follow-up in 3 d for further assessment. In the interim, local measures such as ice and elevation are recommended. You copiously irrigate the laceration and reapproximate the nasal skin with interrupted 5-0 monofilament suture.<sup>10</sup> You control the epistaxis using nasal tampons coated in antibiotic ointment as nasal packing. You confirm the pilot's tetanus status is up to date.

Upon discussion with the specialist after the pilot's assessment, it is decided the otolaryngologist will perform a closed reduction of the acute nasal fracture to realign the skeletal and cartilaginous nasal structures to their pretrauma state, optimize airway patency, and preserve nasal valve structure.<sup>10</sup> Both of these treatment goals are important considerations for aircrew and return to flight status.

After successful closed reduction, a metal malleable splint is applied to the nasal dorsum and the pilot is instructed to wear it for 1 wk.<sup>13</sup> Since the pilot also experienced epistaxis, the otolaryngologist inserted nasal packing to assist with keeping the septal mucosa flat. You place the pilot on restrictions to include no flying duties due to occupational concerns regarding the physical and environmental demands. The pilot continues to recover with adequate analgesic control and reduction of peri-nasal edema.

After 4 wk, the pilot presents to the flight clinic requesting to be medically cleared to return to operational flying status. The pilot has no residual pain with palpation of the nasal bones and is generally accepting of the appearance of their nose. An examination of their ears indicates they have mobile tympanic membranes and are able to demonstrate a proper Valsalva.

You request that they have their aviator's mask refitted by the aircrew life support equipment technicians and receive confirmation they can obtain an adequate seal. You receive an update that they can tolerate an oxygen mask and wear the helmet-mounted display. You support the gradual return to full flight duties, including a session in the simulator while wearing life support equipment and a currency check ride.

The pilot returns to full flight duties and you see them again in follow-up after 2 wk. They report they are able to tolerate wearing an oxygen mask and perform high-G maneuvers. However, the pilot complains of some localized pressure on the bridge of their nose while wearing the helmet-mounted display, which is not significantly distracting. They also mention they

have reduced patency of their right nostril that affects their breathing when they play sports and do other activities.

3. Which of the following are potential causes of nasal obstruction in this pilot?
  - A. Allergic rhinitis.
  - B. Nasal polyps.
  - C. Septal deviation.
  - D. Enlarged turbinates.
  - E. Septal abscess.

## ANSWER/DISCUSSION

3. C. Although each of these conditions may be considered part of the differential diagnosis for an acquired nasal obstruction, the most likely diagnosis is septal deviation. Since it is likely related to the recent trauma, you decide to consult otolaryngology again for further assessment and potential surgical management. Meanwhile, you conduct a thorough clinical history and examination. The pilot denies any previous history of nasal trauma or congenital conditions. They report that they have no known drug or environmental allergies. Their spouse has never indicated they snore and they are not clinically at risk for obstructive sleep apnea. They do not report any sneezing, clear or mucopurulent nasal discharge, or pruritis. You also order some additional investigations to rule out other causes of nasal obstruction and shortness of breath, including allergy testing and pulmonary function tests – the results of both are normal.

The pilot meets with an otolaryngologist, who recommends an elective septorhinoplasty. In addition, the surgeon indicates the possibility of endonasal spreader grafts to achieve nasal patency, as the revision rate for nasal fractures varies from 6% in one retrospective series to 22.5% in another prospective series depending on the patient population and follow-up.<sup>2,11</sup> Identified risk factors for subsequent septorhinoplasty have included a pre-existing diagnosis of nasal obstruction or defect.<sup>8</sup> You review the consult letter and coordinate a suitable timing of the procedure for both the pilot and fighter squadron.

The pilot undergoes a successful septorhinoplasty with endonasal spreader grafts. They are instructed to elevate their head at night, avoid nose blowing, and ice periodically. You see the pilot once again in the flight clinic 4 wk postoperatively. They are doing well and report they no longer have any nasal obstruction and are satisfied with the appearance of their nose. They do not have any nasal edema or pain to palpation of their nasal bridge. They remain on a daily nasal corticosteroid. They want to know when they can return to flying duties.

4. Which of the following is not a potential complication in the treatment of nasal injuries?
  - A. Cavernous sinus thrombosis.
  - B. Septal perforation.
  - C. Sinusitis.
  - D. Migraine headaches.
  - E. Lacrimal duct obstruction.

## ANSWER/DISCUSSION

**4. D.** It is difficult to consider how a nasal fracture could initiate a disorder of migraine headaches; however, it is important to recognize that many patients who complain of sinus headaches actually have migraine headaches. The remaining options are all outlined as potential complications in the treatment of nasal injuries.<sup>10</sup> Cavernous sinus thrombosis can result from an undrained nasal septal abscess. A septal perforation is a potential consequence of an untreated septal hematoma or abscess. Although sinus function is not typically affected due to the anterior location of the quadrangular cartilage, untreated septal deviation can result in osteomeatal complex obstruction. Also, lacrimal duct obstruction can occur from an unrecognized medial orbital rim fracture.

The pilot reports no clinical symptoms related to their nasal passages and sinus function. Your examination of their ears, nose, and throat is unremarkable. You excuse yourself from the exam room to consider the aviator's aeromedical disposition.

## AEROMEDICAL DISPOSITION

Blunt trauma can have a significant impact on the intricate anatomy and functions of the face. It is important for flight surgeons to recognize the acute conditions that may require urgent attention and to coordinate appropriate interventions to restore anatomy and function to facilitate a return to full flying duties.

The reconstructed nose must be reassessed regarding its patency and interface with aircrew life equipment (i.e., aviator's mask) to ensure there are no leaks and the pressure can be tolerated. Each of these aspects is an important consideration for the appropriate disposition of aviators regardless of their flying duties.

Nasal fractures are not explicitly mentioned in the U.S. Armed Forces waiver guides or the Federal Aviation Administration Guide for Aviation Medical Examiners.<sup>5</sup> Instead, there are general ear, nose, and throat statements that indicate the absence of diseases or conditions that interfere with flying or the ability to wear an oxygen mask.<sup>5</sup> The U.S. Air Force Medical Standards Directory indicates that deformities, injuries, or diseases of the nose that interfere with breathing and/or deviations of the nasal septum or other obstructions to nasal ventilation that result in clinical symptoms are disqualifying.<sup>14</sup> In the U.S. Army Standards of Medical Fitness, causes of medical unfitness for flying duty include deviation of the nasal septum that results in symptomatic obstruction of airflow, chronic rhinitis, chronic sinusitis, or interference of sinus drainage.<sup>15</sup> The U.S. Navy Manual of the Medical Department indicates any current nasal or pharyngeal obstruction except for asymptomatic septal deviation must be considered disqualifying for all aviation duty.<sup>3</sup>

There are multiple open and closed surgical techniques that can be implemented to restore the external and internal nasal anatomy. The goal remains to restore function and nasal patency. Close discussions with consulting otolaryngologists should help to identify procedures that are optimal for aircrew in their preservation. Flight surgeons need to remain engaged

with aviators throughout their clinical course, carefully evaluate to prevent subtle or sudden incapacitation upon return to flight duties, and continue to engage necessary specialists to guide the clinical management.

Your keen clinical acumen and patient advocacy contribute to the successful return of this pilot to their flying duties. By taking an active approach it can be expected that all aviators with isolated nasal fractures should be able to return to full unrestricted flight duties.

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