Assessment of nasal trauma

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Introduction

The assessment of nasal injuries requires a delicate balance of history taking and clinical examination. Management of these injuries must take into consideration both functional and cosmetic aspects. Although not an exhaustive review of the literature this paper discusses key aspects of assessment with observations from my own experience.

Pathophysiology

Nasal bone fractures are the commonest facial fracture and make up to 39% of all maxillofacial injuries (1). These types of fractures are mainly seen in road traffic accidents, sports injuries and during physical confrontation. Because of this they are twice as more common in males than in females. The nose is the most prominent feature of the face and has little protection or support.

Nasal bones are very brittle and can be broken easily with trivial impacts. Low impact forces of 30G can be sufficient to result in fracture, compared to the supraorbital rim which requires a force of 200G on impact (2). The ease with which the nose is broken may help absorb the energy of impact and offer some protection to the brain. Thus it has been suggested this acts as a protective mechanism (3).
From the structural point of view the nasal bones are divided into two halves by the intercanthal line - into a stronger upper portion and a weaker lower portion. Most nasal bone injuries occur in the lower segment\(^3\). Injuries to the upper portion therefore represent higher energy impact and should raise concerns regarding extended or deeper injuries. It has also been observed that younger patients tend to have fracture-dislocation of larger segments, whereas older patients (with brittle and less elastic bone) tend to have comminuted fractures. The nasal septum (septal cartilage) supports the lower two third of the nasal framework. It is an elastic structure and can absorb and recoil minor nasal impacts, preventing fractures. The turbinates support the lateral nasal wall (frontal process of the lateral nasal wall) in lateral impact injuries.

Two basic types of impact injuries are seen in nasal trauma

1) Frontal impact injuries – where the impact of injury is from the front / head-on trauma. Here, the fractured segments are displaced inwards and are splayed. Patients often develop saddle nose deformity

2) Side impact injuries. Here the fractured segments are displaced to the opposite side of the point of impact. This is the most common mechanism in adults.

**Clinical features**

Nasal fractures are not life-threatening injuries and therefore it is important to ensure that the patient is stable and more serious injuries are managed first.

Fractures of the nasal bones are compound fractures – almost always. Breaches of the skin or mucosa is present in the vast majority of cases. Hence epistaxis is the rule in most patients. This may have ceased by the time patient, reaches you. Be very careful when you examine such cases as bleeding may restart. If the patient attends 3-4 days after injury then the wound may be infected and antibiotics may be needed. Otherwise antibiotics are usually not needed.

Usually the history is very suggestive of a fracture - the patient receives a blow to the nose. The main clinical features include:

1. Bleeding. If present ask the patient to apply gentle finger pressure until it has settled.

2. Swelling of nose - this appears within a few hours and may obscure details of examination (notably the intercanthal distance). Swelling
increases 4-6 hours after the injury for the first 3-5 days \(^4\), then it subsides.

3. Blood staining (bruising) around one or both eyes - Periorbital ecchymosis. It is worth remembering that a well defined ‘Black eye” indicates the presence of a fracture somewhere (not always the nose). This should prompt careful examination and further imaging.


5. Nasal deformity. The nose may be depressed from the front or the side, or the whole of the nasal pyramid deviated to one side. It is important to consider and exclude any previous deformity.

6. Nasal obstruction due to swelling, septal injury or haematoma. Septal haematoma requires rapid evacuation to prevent septal necrosis and subsequent collapse

7. Lacerations of the skin over the nose with exposure of nasal bones and cartilage may also occur. Rarely is tissue loss significant. Consider the need for antibiotics and tetanus immunisation.

8. In more severe cases there may be ocular / orbital symptoms and a watery nasal discharge - suggestive of CSF leakage

When examining the nose it is important to determine whether it is just a ‘simple’ nasal fracture, or a more serious injury. In more severe cases there may also be orbital symptoms, canthal displacement and watery nasal discharge (CSF Rhinorrhoea). The nasoorbitalethmoidal (NOE) complex is a very delicate and complex structure; it is composed of four bony regions – cranium, orbits, nose and maxilla and four cavities – cranium, orbits, nasal and maxilla. This central crossroad location and collapsible nature due to the deeper ethmoidal sinuses makes it very vulnerable to direct impacts. Symptoms of NOE fractures include significant facial oedema which develops early. Ophthalmic / orbital symptoms include diplopia, telecanthus, enophthalmos, epiphora and a shortened palpebral fissure, which results from orbit wall or medial canthal tendon displacement. Nasal symptoms include collapse (retrusion) of the nasal bridge, anosmia (caused by damage to the olfactory nerve as it passes through the cribiform plate), and nasal congestion, secondary to swelling, septal haematoma or bony / cartilaginous deformity \(^5\). The two main sites from which CSF leakages occur are the cribriform fossa and the roof of the ethmoids. These must both be investigated in suspected cases of CSF rhinorrhoea.

**Examination**

Some authors suggest examination should start distally and move
proximally, dividing the nasal examination into upper, middle, and lower thirds \(^{(4)}\). However the precise sequence is not critical so long as all the steps are completed.

The key issues to consider when examining a patient include:

1. Rapid and confident exclusion of more extensive injuries (most notably NOE / Anterior cranial fossa (ACF) / Orbital walls / ocular injuries). Then note the following

2. Deviation, depression, step deformities

3. Mobility, crepitus, specific areas of point tenderness

4. Areas of swelling, bruising and skin lacerations

5. Septal fracture/haematoma/abscess/perforation

6. Mucosal lacerations

7. Infra orbital numbness – due to injury to the infra orbital nerve. If this is present then the injury is more than a simple nasal fracture.

8. Rhinorrhea - determine whether patient has had epistaxis alone or is combined with watery discharge (CSF).

A simple checklist therefore includes

1 Deformity

2 Septal haematoma / mucosal tears

3 Vision and diplopia

4 Sit the patient forward and look for CSF leaks

5 Measure the Intercanthal distance (ICD)

If swelling is present then assessment of the injury becomes very difficult. The look of the patient often says it all – fracture of the nasal bones is a clinical diagnosis. A comprehensive diagnosis with documentation should include the details of location, extent and displacement of the fractures as far as possible. These can be obtained by the combination of physical examination and radiographic imaging when necessary. Pre-traumatic photographs can provide additional details, particularly if the patient is known to have a pre-traumatic abnormality of the nose / deviated nasal septum.

With questionably injured noses a good method of eliciting the fracture crepitus is by using the 3 fingers of your dominant hand – the Index finger is placed on the dorsum, with the thumb and the middle fingers on the sides. Then gently move the nose from one side to the other (after informing the patient this may cause mild discomfort). Any fracture present produces crepitus which can be easily felt and occasionally heard. Crepitus, tenderness, depression, step-
offs, nasal shortening, or widening of the nasal base are indicative of fracture. However any injury without some degree of bleeding is unlikely to be a severe fracture (6).

In severely displaced, depressed or deformed cases examination does not need to elicit crepitus and movement. However it is still important to assess the other elements in the checklist. If the patient has a significant watery rhinorhoea he/she should be assumed to have a cerebrospinal fluid (CSF) leak. From a practical viewpoint any suspected CSF leak requires a neurosurgical opinion or advice.

CSF is confirmed by either performing a bedside test for the Halo sign, or by testing fluid levels for either glucose or β-transferrin. The “halo” or “double-ring” sign uses the principle of chromatography: different components of a fluid mixture will separate as they travel through a material. Although the value of this sign has been debated, studies have shown that the sign is consistently positive when CSF concentrations are 30%–90% of the bloody discharge. However, this sign is not specific for CSF alone: mixtures of blood with saline and tears also produced halos. It is therefore not 100% reliable. Filter paper, paper towels, coffee filters and linen can all be used to show a ring (7). Laboratory test for β-transferrin are the most reliable. This is present mostly in CSF with a little amount in eye fluid. It is not present in blood, saliva, or nasal secretions.

Types of fractures

In clinical practice the following types of fracture may be evident:

A. Fractures confined to the nose

1. Fractures involving only the Nasal bones – here only the dorsum of nose is deformed. Depending upon the displacement of the distal segment it can be either depressed (more common) or elevated (less common). This can happen in both frontal and lateral impact injuries. Often no significant haematoma is seen around the eyelids.

2. Unilateral fractures involving the nasal bones and frontal process of maxilla – here in addition to the previous findings the lateral wall of nose is depressed to the side opposite to the site of impact. The disfigurement here is more significant than the first case. This usually happens in side impact injuries. There is often mild haematoma in the eyelids of the involved side.

3. Bilateral fractures involving the nasal bones and frontal process of maxilla. This is usually seen following frontal impacts with increasing disfigurement than previously. Most of the entire nose appears depressed. There
is usually haematoma in the eyelids on both the sides.

**B. Fractures extending beyond the nose**

4. Bilateral fractures involving the nasal bones, ethmoids and frontal process of maxilla. The entire nose is depressed and sunken inside. Telecanthus may be seen in these cases. There is usually haematoma in the eyelids on both the sides. These injuries are often associated with other facial injuries including the orbits.

5. Fractures involving the orbits along with nasal bones and the ethmoids. (Nasoorbitalethmoidal – NOE fractures). These are more severe injuries and ocular function may be affected, depending upon the severity of ocular injuries. 1 & 4 (NOE fractures) are commonly classified according to the attachment of the medial canthus to the bone (Markowitz classification)

6. Fractures involving the anterior cranial fosse along with orbits, nasal bones and the ethmoids. These are the most severe types of fractures and besides nasal disfigurement patients also have watery nasal discharge (CSF). These should be considered as head injuries and referred accordingly. The nasal fractures are a lower priority at this time.

**C. Fractures of the septum**

Septal fractures can occur with any of the above fractures. The sepal fracture associated with isolated fractures of the nasal bone is of three types–

i) Chevrolet fracture. This is a vertical fracture of nasal septum which occurs when the direction of blow on the nose is from below upwards (8, 9)

ii) Jarjaway fractures are a horizontal fracture of nasal septum. These occur when the direction of blow on the nose is from the front (10).

iii) A third type is a crushed septum when the impact force is significantly more and from the front. The septum is often crushed and highly comminuted.

It is important to note that septal fractures can occur in the absence of nasal bone fractures. This usually happens in frontal and below-upwards impact injuries.

One of the consistent signs in septal fracture is a mucosal tear. This must be looked for in all cases during examination. If not identified there is a chance of missing a nasal septal fracture. Fortunately the likelihood of infection is very low but failure to manage the septum correctly will result in residual deformity. Deviation may not always be seen in septal fractures because of the
elastic recoil, hence its absence should not rule out a fracture.

Due to the intimate associations of the bony and cartilaginous portions of the nose and the septum it is unusual to see fractures to either structure without damage to the other. Septal fractures tend to release interlocked stresses. There are forces locked within the matrix of the cartilage existing in a state of balance, the outer layers being in a state of tension, the inner layers being largely maintained in a state of compression. These forces have been termed "interlocked stresses" (11). During the process of healing by fibrosis this may result in septal twisting into various configurations (C-shaped, S-shaped), or spurs. Septal fractures also are frequently associated with "telescoping" of the fractured edges causing a retracted appearance of the cartilaginous portions of the nose and a depressed dorsum.

It is therefore important to always assess the septum carefully. If not done so many patients develop nasal obstruction or sinusitis later.

Other classifications of nasal bone fractures are described.

1) Stranc Robertson classification
2) Harrison’s classification
3) Murray’s classification.

Extent of deformity

A five point grading system has been developed to help describe the extent of lateral deviation of the nasal pyramid:

Grade 0: bones perfectly straight – undisplaced fractures.

Grade 1: bones deviated less than half of the width of the bridge of the nose

Grade 2: bones deviated half to one full width of the bridge of the nose

Grade 3: bones deviated greater than one full width of the bridge of the nose

Grade 4: bones almost touching the cheek

This grading system is helpful in preoperative assessment of injury, deciding whether to do closed or open reduction and comparing postoperative results.

The role of radiological evaluation

The need for X-rays of the nose is controversial and whilst some clinicians will request imaging, others will not. In the UK for example, X-rays of suspected isolated nasal fractures are almost never requested.

However if imaging is considered necessary, the three basic radiological investigations reported are Plain radiography, CT and ultrasonology (12)

A. Arguments for obtaining plain films include:
1. It is a good tool for documentation of injury when CT not available

2. Universally available unlike CT.

3. Economical – the cost of X-ray is only 5-6% as compared to CT scan

4. It may be helpful in undisplaced fractures where clinically nasal structure appears normal and we may not require a CT scan.

B. Arguments against plain films include:

1. It does not give any addition information for management above clinical examination. True lateral x-rays taken under less than ideal circumstances are usually non-contributory. Furthermore, plain film images frequently fail to give sufficiently detailed information as to the nature and extent of any neighbouring injuries (such as skull base fractures, orbital wall injuries, pterygoid plate fractures and sagittal fractures of the maxilla and condylar process of the mandible). So they are of limited use

2. According to Sharp (12) X-rays of nasal bone fails to reveal fractures in nearly 50% of the patients.

3. The amount of radiation exposure is very high – hence must be avoided.

Therefore it is best to refer to local guidelines, depending on where you live. For those countries where imaging is routinely required the following information may be useful.

1) Usually we take a lateral skull X-ray for nasal bones which usually shows the fracture clearly. The only problem with this view is that it does not show any fractures of frontal process of maxilla because the two sides overlap. In fact no plain X-ray view clearly shows the fracture in the frontal process of maxilla. Therefore there are limitations with plain films in visualizing nasal fractures. Since X-ray provides limited information CT scan may be considered.

2) CT is of value in high energy injuries, not only to determine the extent of the nasal fracture but also to exclude deeper and hidden fractures to the skull base and orbits.

   CT scan of paranasal sinus with 2mm sections (both axial and coronal) is required. This will clearly show all the fractures including the ethmoids, orbits and skull base.

   The main advantages of CT scan include:

   a) High accuracy in evaluating both bony and soft tissue injuries.

   b) More sensitive than plain film in fracture detection

   c) Easier to perform.
d) Radiation dose far below threshold dose for cataract formation.

The main disadvantages of CT scan is that it is not universally available at all centers and is expensive. Whilst it can theoretically be used in pregnancy, many specialists prefer to avoid for a relatively minor injury (relative contradiction)

Computed tomography is very helpful in diagnosing septal fractures although it can not predict severity accurately. Its role in planning management is therefore limited (13).

3) Ultra sonography: In some countries ultrasound is increasingly being recognised as a tool for investigating nasal fractures. It has the clear advantage of being non invasive and has zero radiation hazards. Ultrasound using 10 MHz probe gives a clear view of the nasal bone area thereby facilitating easy identification of fractures. Many images can be taken without any technical problems. It is also cost effective. Unlike X-ray it can tell us about the presence of ethmoidal and orbital fractures although the anatomy can not be used to plan surgery. Other advantages of ultrasound is that it is easy and quick to perform, inexpensive, portable and non-invasive. In one study the precision of ultrasonography and CT scan of the nasal bone were similar. However, the sensitivity and specificity of ultrasonography has not been tested in the diagnosis of nasal bone fractures (14).

**Learning points**

1 Nasal bone injuries are a common sequel to road traffic accidents, sports, or direct confrontation; they are the commonest nasal facial fractures.

2 Early diagnosis and treatment are key to a successful management.

3 These injuries can be deceptive - always consider deeper and more serious injuries.

4 CT scan is the best modality in evaluating these injuries. The role of plain film radiography is controversial and at best very limited.

5 If properly assessed and managed results are often very good.
References


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