20 The Upper Jaw ("Midface") and Sinuses: Part III

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20.1 Injuries to the Midface

Fractures of the midface can result from a variety of high-energy impacts. Injuries to the lateral midface occur more frequently than central ones. The extent and pattern of the soft tissue and bony injuries varies according energy of impact. Isolated fracture is most common with lower energy trauma, whereas high energy blunt and penetrating trauma results in more complex, less predictable injury pattern. The most common mechanisms of injury for these fractures (which are frequently associated with drug and alcohol abuse), include motor vehicle collisions, assault and falls. Because of their proximity to the airway, ethmoid (and other) vessels, orbits and upper teeth they can be both life and sight-threatening problems as well as be disfiguring. However not all fractures are this severe, or obvious. Patients can walk into an emergency department with their injury, even if it is significant. Clinical presentation can therefore be highly variable. The different types of midface fractures overlap somewhat and also include dentoalveolar fractures in the maxillae. Fractures are often referred to as "Le Fort" fractures, although this is probably not that useful in an emergency context. Today, as a result of changing mechanisms of injury, these fractures are often asymmetric, comminuted and complex. With high energy impacts there may also be associated fractures of the nose, nasoorbitoethmoid (NOE) region and zygoma. In some patients fractures may extend upwards into the anterior cranial fossa. This should be carefully considered in all upper midface injuries—patients may appear deceptively well, despite having significant fractures. CT is now the standard for evaluation of suspected facial fractures. It is readily available, rapidly acquired and very accurate in detecting even subtle fractures. It can also be used to simultaneously evaluate for intracranial, orbital and cervical

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injury. 3D reconstructions are useful in surgical planning. From a practical point of view injuries to the midface can be considered as

- Dentoalveolar fractures
- LeFort fractures
- Extended fractures (Fig. 20.1)

20.1.1 Dentoalveolar Fractures

These can occur in both the upper and lower jaw. Although alveolar fractures occur predominantly in dentate arches, they can also occur in edentulous arches. Injuries to the teeth themselves are discussed in detail in the chapter on the mouth. Dentoalveolar fractures are defined as fractures to the teeth and their supporting alveolar bone. They can be categorised into two types—the first type is confined to the area surrounding a single tooth, the second type can be defined as 'regional'. This is generally easier to detect since the entire dento-alveolar segment is disrupted. Dentoalveolar trauma involving multiple teeth are common. Among children, these are frequently caused by bicycle injuries, falls, sports injuries and, occasionally, car crashes and child abuse. In adults, causes include assaults, motor vehicle crashes, falls, contact injuries and occasionally work-related trauma. Although alveolar fractures can occur at any age, the first and second decades after

Fig. 20.1 Typical blunt midface injury demonstrating stabilization of the neck with a cervical collar, oral intubation, facial edema, periorbital eccymoses, and a posterior nasal pack (Foley catheter) and anterior nasal packing to control nasal bleeding. Marked facial edema develops within a few hours of injury making

the permanent incisors erupt are the most common. The highest prevalence is among children and adolescents during dental and alveolar development. The teeth themselves may also be fractured along their crowns or roots. They may also be loosened or even avulsed. Usually these are the anterior teeth, particularly the maxillary incisors. The deeper location, anatomic shape and high density of the cortical bone makes the posterior dental segments less prone to fracture. In view of the risks of aspiration (which are increased if the patient was knocked out), all missing teeth should therefore be accounted for. A useful tip is to ask the patient to pass their tongue around the inside of their mouth and point out any changes to the teeth or fillings. We all know our own mouths well and this step helps identify subtle changes. Other important clinical signs include intraoral bleeding, a change in the patients bite and pain. Although these injuries often occur in isolation and are usually readily identifiable, it is also important to consider the possibility of associated fractures to the supporting jaw. All dentoalveolar fractures should be regarded as open fractures.

Initial management includes appropriate imaging (OM/OPG/CT as indicated), antibiotics, tetanus prophylaxis (when necessary) and temporary reduction and support of displaced or mobile fractures. Refer urgently to the patient's own Dentist, Dental school, or Maxillofacial department (depending on local circumstances). Splinting of the teeth is usually the treatment of choice. Unlike management of tooth avulsion, fixation for alveolar fractures should be sufficient rigid in order to allow bone healing. However this should not be rigid, while maintaining fixation of the alveolar segment, the splint should allow a minor degree of physiological movement across the fractured alveolar segment. This is known to promote healing. There are various types of rigid fixation, such as wiring with arch bars, composite splint, plate and screw fixation. The choice of the splinting method depends on the type of alveolar fracture and the number of teeth presented in the arch. The duration of the fixation can vary between 4 and 6 weeks. The key to adequate immobilisation is to anchor the fracture segment rigidly to at least 3–4 stable teeth on both sides of the fractured alveolar segment. During this time the patient should only eat very soft foods, avoid biting on the splinted teeth and keep the mouth as clean as possible. Mucosal tears should be repaired to cover any exposed bone. In the long term, maxillary alveolar ridge injury can cause severe alveolar ridge deficiency, ridge atrophy, lower midface retrusion and future rehabilitation difficulties. These long-term consequences of dento-alveolar trauma mismanagement can be devastating—and sometimes used as a basis for litigation.

20.1.2 Midface (Le Fort) Fractures

All Le Fort fracture types involve the pterygoid processes of the sphenoid bones and therefore, disrupt the buttress system to the midface. As with any initial trauma evaluation, the first priority is the primary survey, as discussed in the chapter on the injured patient. Following this, a detailed history of the event should be determined from the patient, witnesses, or first responders. Important questions include

i) Have you had any trouble with your vision?
ii) Have you had any problem hearing?
iii) Do you have difficulty breathing through either nostril?
iv) Do you have any facial numbness?
v) Have you had any problems with your bite since the injury?
vi) Have you had bleeding or leakage from your ears, nose, or mouth?

Clinical differentiation of Le Fort types I, II, and III depends on involvement of the maxillary, nasal, and zygomatic bones. The oral cavity should also be assessed for mucosal lacerations, ecchymosis, and the presence of bone fragments. Injury to the mucosa may suggest either alveolar or palatal fractures. Each tooth should be assessed for mobility. Mobility of the midface itself may be obvious or subtle. If it is not obvious it is can usually be detected by careful clinical examination. This should only be done once the cervical spine has been "cleared" and there are no concerns about the neck. If not, this part of the examination can be safely deferred (so long as the airway is secure and there is no active bleeding).

i) Gently grasp the anterior maxillary bone and with a slow rocking motion feel for movement.
ii) At the same time use the other hand to feel for movement at the sites commonly known to fracture. These are i) the nasal bridge ii) the inferior orbital margins and iii) the frontozygomatic sutures).
iii) If the teeth and palate move but the nasal bones and inferior orbital rims are stable, a Le Fort I fracture is present (or you are moving a denture).
iv) If the teeth, palate, nasal bones and inferior orbital rims move, but the lateral orbital rims are stable, this is a Le Fort II fracture.
v) If the whole midface feels unstable, it is probably a Le Fort III or some other complex fracture pattern (Figs. 20.2, 20.3, 20.4 and 20.5).

The tongue blade test is another useful manoeuvre. This is done by asking the patient to bite down hard on a tongue blade (wooden spatula). This will be painful if the jaw is fractured. The "level" of Lefort fractures refers to the level of the fracture in relation to the skull base. There are generally three.

20.1.2.1 Le Fort I ("Low Level")

Le Fort I fractures are horizontally orientated fractures of the maxilla that occur above the palate and alveolus and extend through the piriform aperture and lateral nasal wall and the pterygoid plates. They are therefore mainly in the horizontal plane. Fractures result from a downward force applied to the maxillary alveolar bone, resulting in a mobile maxilla by fracturing all four of the vertical buttresses of the midface. The fractures passes through the lower third of the nasal septum and the lower part of zygomatic buttress. These fractures result in mobility of the tooth-bearing maxilla and hard palate and are associated with malocclusion and dental fractures. In terms of geometry, think of an upper denture (Fig. 20.6).

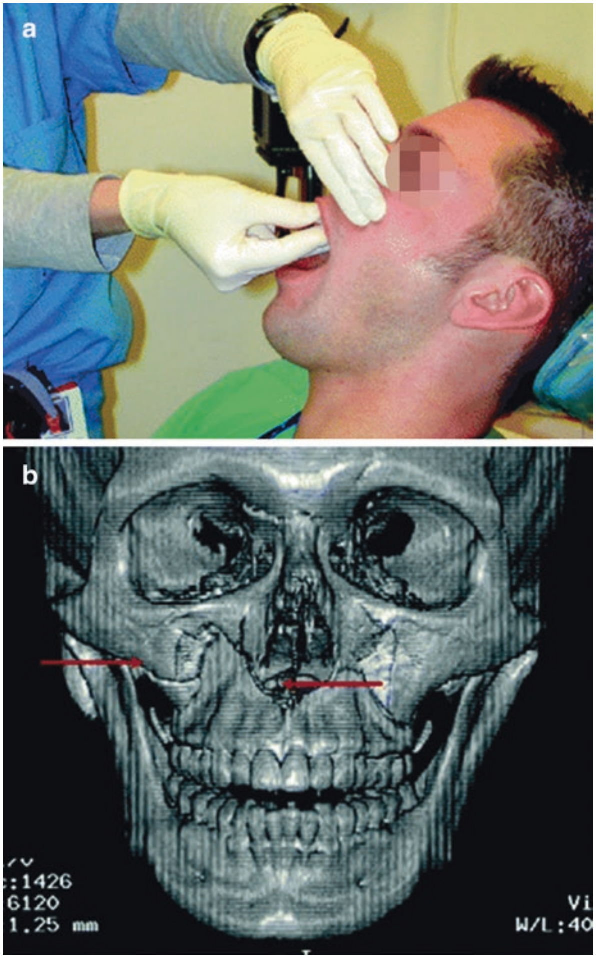


Fig. 20.2 (**a**) Clinical examination and (**b**) three-dimensional CT of Le Fort I fracture. Notice the correlation between the fracture line on CT (*arrows*) and the area being palpated for mobility on the clinical picture

20.1.2.2 Le Fort II ("Pyramidal")

Le Fort II fractures are pyramidal in shape and involve the zygomaticomaxillary suture, nasofrontal suture, pterygoid processes and the drainage of the frontal sinus. They can cause significant disruption of the medial, lateral, upper transverse, and posterior maxillary buttresses and produce separation along the inferior orbital rims (a key site in examination). Commencing at the nasal bones, the fracture crosses the frontal processes of the maxillae on either side, passing into the medial orbital walls. It then passes through the lacrimal bones and crosses the inferior orbital margin near the infraorbital foramen. The fracture continues downwards and backwards through the lateral wall of the antrum below the zygomatico-maxillary suture. Posteriorly it passes midway through the pterygoid plates. It also passes through the nasal septum and may involve the cribriform plate of the anterior cranial fossa. Involvement of the orbit can lead to the development of complications including extra-ocular

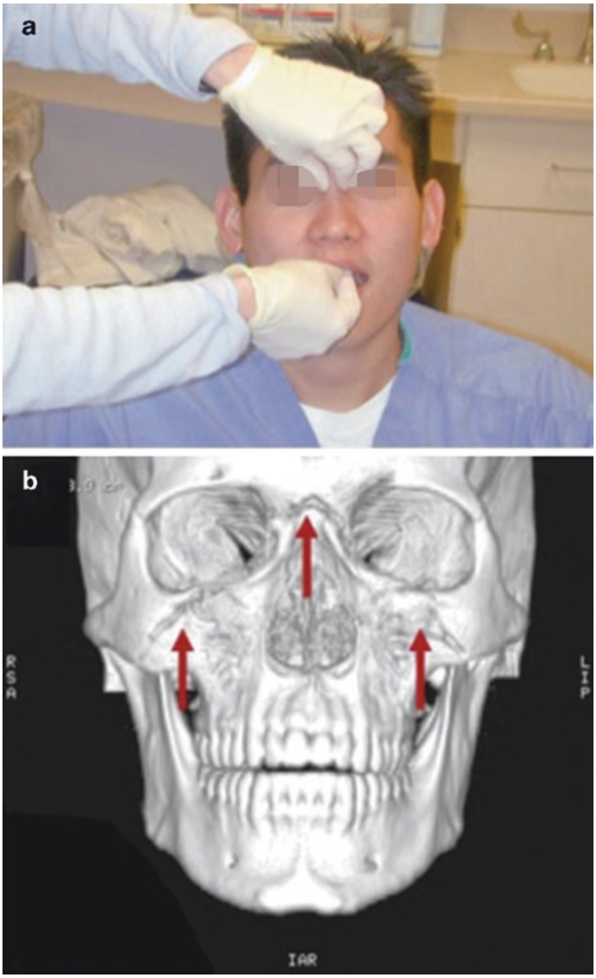


Fig. 20.3 (**a**) Clinical examination and (**b**) three-dimensional CT of Le Fort II fracture. Notice the correlation between the fracture line on CT (*arrows*) and the area being palpated for mobility on the clinical picture

muscle injury, orbital haematoma, globe rupture or optic nerve injury. Epistaxis, CSF rhinorrhea, lacrimal duct and sac injury, medial canthal tendon injury and frontal sinus drainage obstruction can also occur (Fig. 20.7).

20.1.2.3 Le Fort III ("High Transverse" or "Craniofacial Dysjunction")

Le Fort III fractures involve the nasal bones, medial, inferior, and lateral orbital walls, pterygoid processes and zygomatic arches. This results in complete separation of the midface from the cranium. Commencing at the nasal bones, the fracture passes symmetrically from the frontonasal suture posteriorly through the ethmoid bone (and cribriform plate). It then passes laterally through the orbit below the level of the optic foramen to reach the posterior aspect of the inferior orbital fissure. From here the fracture passes laterally through the lateral wall of the orbit and

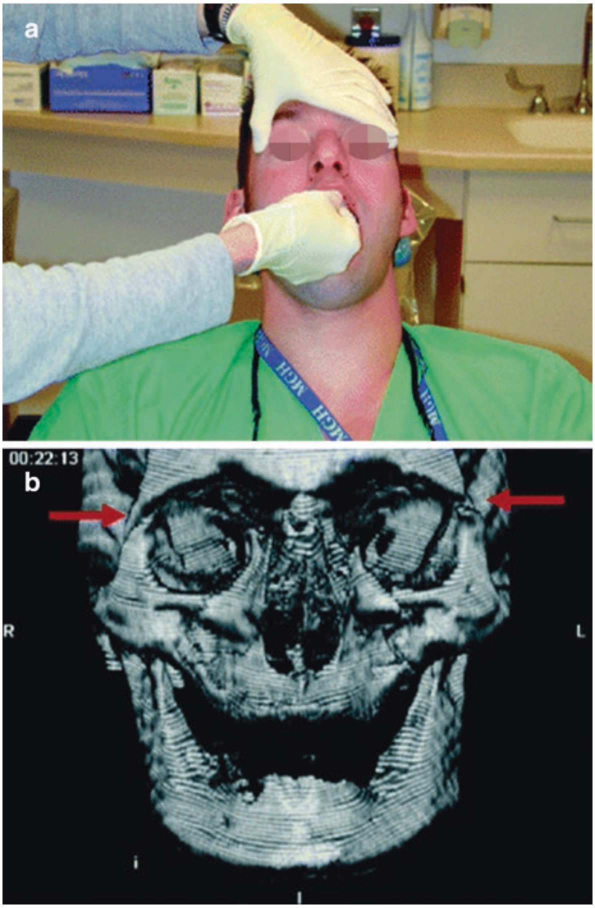


Fig. 20.4 (**a**) Clinical examination and (**b**) three-dimensional CT of Le Fort III fracture. Notice the correlation between the fracture line on CT (*arrows*) and the area being palpated for mobility on the clinical picture

frontozygomatic process. Posteriorly it crosses the pterygomaxillary fissure and the base of the pterygoids. This separates the entire facial skeleton from the skull base. These fractures thus affect the medial maxillary, lateral maxillary, upper transverse maxillary, and posterior maxillary buttresses. Similar to Le Fort II fractures, they can be associated with orbital complications and CSF rhinorrhea (Fig. 20.8).

Both LeFort II and III fractures involve the orbit, with risks of injury to the globes and their associated structures. They also have the potential to extend upwards and involve the anterior cranial fossa, with risks of head injury/CSF leakage—these are sometimes called "extended" fractures. Today, pure Le fort fractures are generally uncommon and they are commonly associated with additional midface fractures, including nasoethmoid, palatal, zygomaticomaxillary and dentoalveolar. Therefore do not be surprised if the clinical picture doesn't fit any of the above descriptions neatly. That is not important. The detection of mobility is—this indicates a significant injury and the need for urgent CT. If mobility is detected, revisit the assessment of the eyes and CSF leaks.

Fig. 20.5 Deranged bite with premature contact on one side and shifting of the upper midline

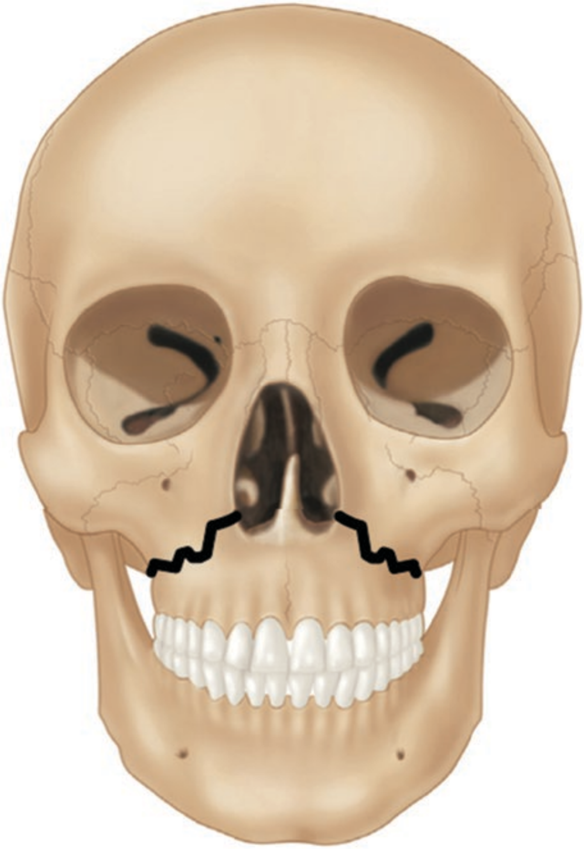


Fig. 20.6 Le Fort I

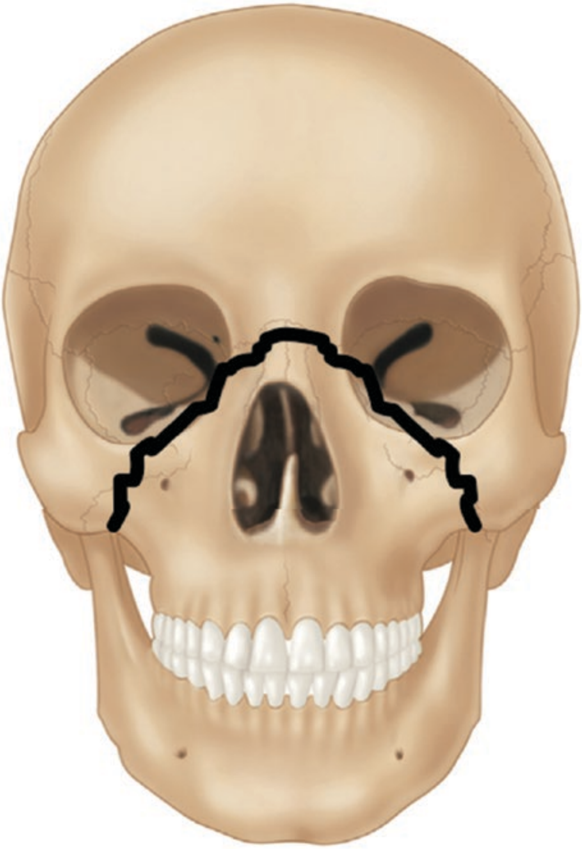
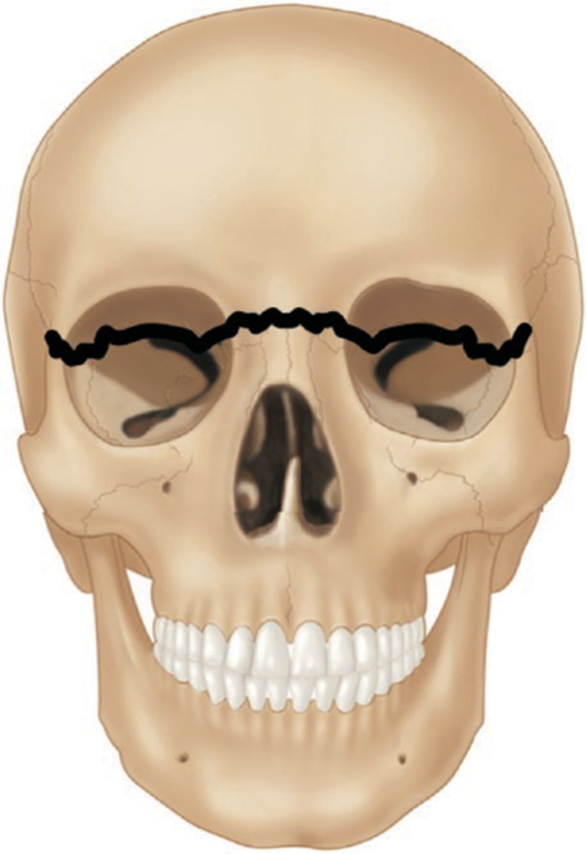


Fig. 20.7 Le Fort II

20.1.3 Split Palate

Traumatic injuries to the hard palate occur in about 20% of all blunt midface fractures. Gunshot wounds account for a significant numbers with major disruption of the palate and are managed differently (often requiring soft tissue free flaps and bone grafts). The hard palate forms a platform on which several of the facial buttresses arise. As such, any disrupted geometry of the hard palate can have an adverse effect on the three-dimensional appearance of the face. This is most notable with regards to the transverse width and projection of the cheeks and central midface. The bones comprising the hard palatal bone vary significantly in thickness being thicker anteriorly and progressively thinning towards the soft palate. The bone is also relatively thin in the midline sagittal plane. Usually the side of a palatal split is related to the side that receives the highest impact. Midline or asymmetric splits occur following high-energy impacts. They are rarely seen in isolation and usually indicate the presence of more widespread fractures of the midface. These should be distinguished from dentoalveolar fractures, which are more common, follow lower energy injuries and often occur in isolation. These injuries are described elsewhere

Fig. 20.8 Le Fort III



in this book. Clues to the presence of a palatal split include bruising in the region of the greater palatine vessels (Guerin's sign), palatal mobility, an asymmetric bite, or a patient having difficulty swallowing. The hard palate doesn't usually swell much as the mucosa here is tightly bound to the bone. Instead the mucosa tends to tear (Fig. 20.9).

A simplification of the classification of fractures of the palate has been proposed as an aid to understanding the patterns of fracture and treatment planning. Fractures can be classified as

i) Sagittal
ii) Parasagittal
iii) Palato-alveolar
iv) Anterior
v) Anterolateral
vi) Posterolateral
vii) Transverse or oblique
viii) Comminuted (polydirectional)

20.1.4 Extended Fractures

These are fractures which pass beyond the LeFort regions into the adjacent bones (zygoma, nose, NOE etc). Their pattern varies widely, depending on the mechanism of injury, point of impact and energy transfer. If the skull is fractured these are referred to as 'craniofacial fractures'. In the first instance these should be regarded as significant head injuries and assessed and managed accordingly. These injuries should also be urgently referred to the local specialist in facial trauma (Maxillofacial,, Plastics or ENT, depending on local arrangements) for advise regarding the facial injuries themselves. If the mandible is involved these injuries are sometimes referred to as 'panfacial' fractures (Fig. 20.10).

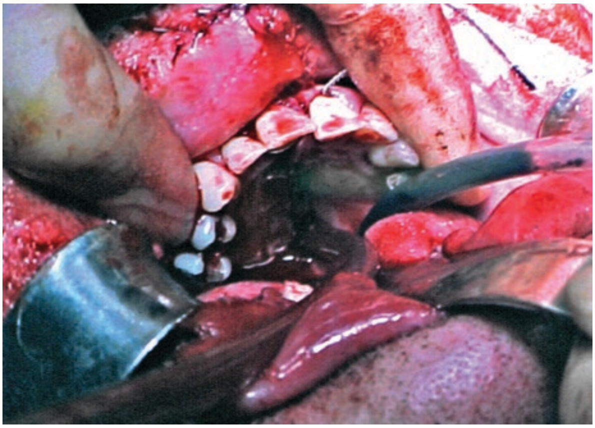


Fig. 20.9 High energy impacts can split the palate. This is key to successful repair

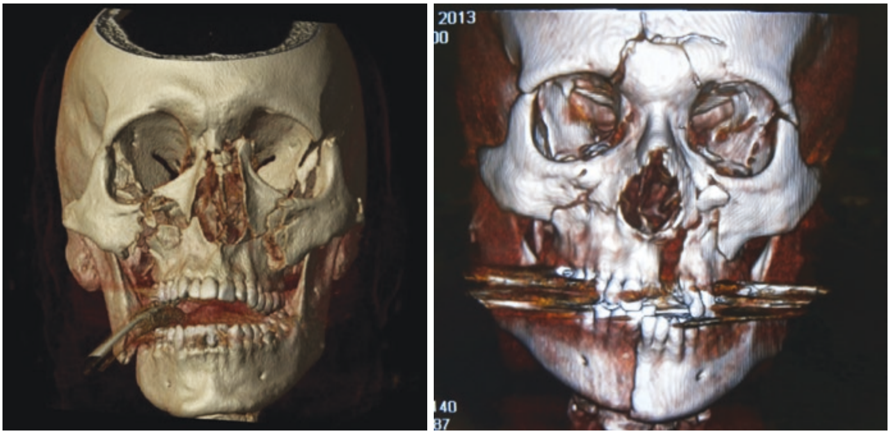


Fig. 20.10 Panfacial fractures

Clinical features and management therefore vary widely and will include aspects of management specific to the additional bones as described in their relevant chapters. Although highly variable, these should all be regarded as severe injuries and managed as such. Assessment should consider the following—although the following list is long it would be a very unlucky patient indeed if they had all these findings.

- General features
  - Airway compromise (usually from varying combinations of bleeding, swelling, supine position, alcohol and head injury)
  - Haemorrhage—This is usually due to displacement of fractured bones or mucosal tears in the nasopharynx or facial wounds/lacerations. This is rarely significant, although it may require nasal packing or immediate manual reduction of the midface fracture to stem the flow. If the patient is shocked, always consider another cause
- Neurosurgical related
  - CSF Rhinorrhoea (anterior cranial fossa #). CSF rhinorrhoea is indicative of severe central middle third and nasoethmoidal fractures with anterior cranial fossa extension. This may initially be missed if the patient is supine or is bleeding from the nose.
  - CSF Otorrhoea (middle cranial fossa #)
- Facial Swelling—this can rapidly progress with high energy impacts. Oedema and swelling may mask fractures, but note any asymmetry, deviation or flattening of the nasal bridge. Consider early intubation
- Abnormal mobility of the midface—hold the anterior maxillary alveolus and gently rock the maxilla. Do not attempt this if the patient has been bleeding significantly from the face—it may restart.
- Eye/orbit
  - Bilateral peri-orbital ecchymoses (“Panda Faces” or “Racoon Eyes”). These are often associated with facial swelling and are seen in any fracture that passes into the orbit.
  - Bilateral subconjunctival ecchymoses (appears bright red). This is bleeding within the conjunctiva adjacent to an orbital fracture. With no posterior limit—strongly suggests a bony injury. Lateral segmental haemorrhage—suggests a malar fracture. Bilateral complete subconjunctival haemorrhages—usually indicative of an anterior fossa fracture extending into the orbits.
  - Enophthalmos—this may be initially masked by oedema.
  - Diplopia—This has many causes and may be difficult to assess at an early stage, unless it is obvious.
  - Traumatic mydriasis (dilated pupil)—spasm of dilator pupillae secondary to a direct blow.
  - Medial canthus—displacement often occurs laterally and inferiorly. The normal intercanthal distance is around 35 mm or roughly the same length as the palpebral fissure. An easy check is to apply traction to the lateral canthus.
- Features related to the displacement of the midface skeleton

  - Obstructed Airway—this results from a combination of soft palate displacement, swelling and bleeding.
  - Anterior Open Bite
  - Apparent restricted mouth opening. This is caused by premature contact in the molar region which results in propping open of the occlusion.
  - Lengthening of the face (long face)
  - "Dish-Faced" Deformity—comminution of the bones may result in collapse of the central part of the face, rather than displacement of the whole face.
  - Pain and crepitus
  - Displacement of the nasal septum can be seen by lifting the tip of the nose following insertion of a nasal speculum
- Upper Buccal Sulcus/palatal bruising
- Numbness—in the distribution of the infraorbital nerve.

"Tramlining" and CSF leaks are discussed in detail in the chapter on the head. This may be seen when blood mixes with CSF and leaks from the nose, ear or (rarely) the orbit. Along the periphery of this flow the blood clots while the CSF washes it away centrally forming two parallel lines, hence the term "tramlining".

High energy injuries should be initially assessed using ATLS principles (see the chapter on the Injured patient). Consider multiple facial/midface injuries in anyone with gross facial swelling following trauma. Early referral is often indicated. Midface injuries not associated with airway obstruction or major bleeding, should be treated only after the patient has been stabilised and any life-threatening injuries have been managed. To briefly summarise, consider first

- Airway with Cervical spine protection. Remember these injuries can swell quickly
- Breathing—give oxygen and consider the possibility of a tooth/teeth or dentures in the bronchial tree.
- Circulation—bleeding from the midface is common, but rarely severe. It may be difficult to recognise in the supine, awake patient.
- Head injuries
- Ocular injuries

Beware the patient who keeps trying to sit up—they may be trying to clear their airway.

20.1.4.1 First Aid Measures

- Airway compromise to some extent is not uncommon in patients who have sustained high energy injuries to the midface. Bleeding, swelling, and oral secretions may quickly endanger the supine patient's airway. Judicious use of oropharyngeal suction is advised, and if necessary the airway should be secured. It is wise to have both oral intubation and cricothyrotomy kits available. Midface fractures can present with significant epistaxis. As a first aid measure nasal packs may be required. Nasal packing is discussed in the chapters on the injured patient and the nose. Specific tamponade devices (or if necessary urinary catheters) may need to be inserted first to obturate the nasopharynx. Custom devices are available (EpistatTM) with dual balloons that will occlude the entire nasal airway and hence tamponade haemorrhage. This facilitates nasal packing with ribbon gauze. However beware inflating balloons in the presence of mobile fractures—these may displace further. Remember to replace lost fluids. Patients with midface fractures should have IV access and appropriate fluid resuscitation. Keep them fasted until seen by a specialist, just in case early intubation is indicated. Remember that blood is a potent stimulus to vomiting. Consider antiemetics (non sedative)

- Dentoalveolar fractures should be reduced and temporarily stabilised. If teeth have been avulsed or subluxed they should be re-implanted or repositioned as soon as possible and then splinted. Missing teeth should be accounted for.
- Lacerations should be managed as discussed in the chapter on the injured patient. If the patient obviously needs to go to theatre soon, formal wound closure can be postponed. A few holding sutures or steri-strips and a simple dressing should be placed.
- Prevention of infection—Midface fractures are at risk of infection via the sinuses, teeth or wounds. Antibiotics should be commenced. Many regimes exist and include Augmentin, or Benzyl Penicillin + Metronidazole. Consider Tetanus prophylaxis.
- Analgesia—Although often prescribed, facial fractures are often not as painful as one may think. Avoid opiates until the patient is cleared of a head injury
- Advise the patient not to blow their nose. They are at risk of both surgical emphysema and tension pneumocephalus.

20.1.5 Controlling Midface Bleeding

Control of midface haemorrhage requires a variety of interventions, depending on the site of blood loss and urgency of control. In some cases it may require unrestricted access to the mouth, throat and nose, necessitating the unfastening of any cervical collar. During this, the cervical spine must remain carefully immobilised, making this (at the least) a two person job. In some cases intubation may be required simply to facilitate effective haemorrhage control. Subsequent control of midface haemorrhage requires correct sequencing. Packing the nasal cavity in an unsupported fracture may distract fractures, resulting in further bleeding. The following sequence is therefore recommended.

i) Displaced mandibular fractures rarely bleed significantly, but can be painful and result in agitation. If possible these should be gently reduced and the lower jaw supported by the collar. Collars must be well fitting. If not they can displace the fractures further. Consider intubation in highly mobile or comminuted fractures, particularly if there is significant swelling—this will get worse. Tongue movement is a good guide to swelling within the floor of the mouth.

ii) When displaced midface fractures are present, early manual reduction not only improves the airway, but helps control blood loss. Once reduced, a mouth prop can help maintain support. If the mandible is also fractured, this needs additional support.

iii) In extensive facial injuries, early intubation should be considered, not only to protect the airway, but also to allow effective control of bleeding. If anaesthesia and intubation are not undertaken, the patient needs to be monitored very closely. Failure to control haemorrhage by simple measures is an indication for anaesthesia and intubation.

iv) Following induction of anaesthesia and intubation, manual reduction of the fractures can then be carried out more readily. This technique is comparable to the manual reduction of a displaced femoral or pelvic fracture when controlling haemorrhage

v) If fracture reduction proves to be effective, temporarily stabilisation using mouth props, gauze or wires is undertaken.

vi) Epistaxis may be controlled using a variety of specifically designed nasal balloons or packs. If these devices are not available, two urinary catheters can be used. One is passed through each nostrils into the pharynx (under direct vision), inflated with saline, and then gently withdrawn until the balloon wedges in the postnasal space. The nasal cavity can then be packed. The balloons essentially form a posterior stop, preventing the pack from falling through the nasopharynx into the throat. Bleeding initially continues but should soon tamponade. If it does not, consider acquired coagulation defects. These techniques are commonly a source of anxiety when there are concerns about the possibility of skull base fractures and risks of intracranial intubation. However, if there is profuse haemorrhage from the midface, something needs to be done and the patient cannot be allowed to exsanguinate on the basis of a perceived risk. In such circumstances, safe passage of a soft catheter, under direct vision, is usually possible. It is important to know the anatomy—soft tubes gently passed parallel to the hard palate are very unlikely to end up in the brain.

vii) Aggressive packing should be avoided, especially if anterior cranial fossa or orbital fractures are evident or suspected. Overpacking may inadvertently displace these fractures (Fig. 20.11).

These manoeuvres should only be regarded as resuscitative measures, in much the same way as wrapping a sheet around a reduced "open book" pelvic fracture reduces blood loss. The fractures are not anatomically reduced and nasal packs are not without risk. Toxic shock, sinusitis, meningitis, and brain abscess are all potential complications. Blindness has also been reported. How long packs are

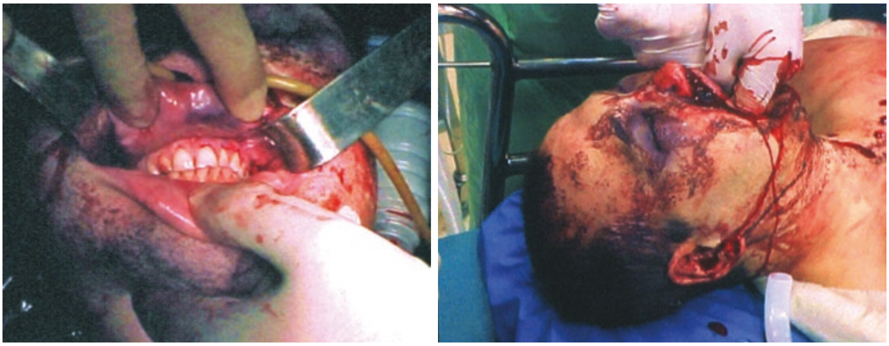


Fig. 20.11 Manual reduction initially controls blood loss in most cases—remember the airway may be at risk

left in situ depends on the clinical status of the patient, but is usually around 24–48 h. Antibiotics are usually prescribed. If bleeding continues despite all these measures (and there are no clotting abnormalities), further interventions today are more radiologically driven. Surgical ligation of the external carotid and ethmoidal arteries is rarely indicated following blunt trauma and is extremely difficult to undertake as an emergency procedure. Anecdotally, this is a time-consuming procedure, with variable success rates. Due to the extensive collateral circulation of the face, ligating a single vessel is unlikely to be successful. Add to this the urgency of haemostasis and the fact that the cervical spine may not have been "cleared" (thereby preventing turning of the head for access), these techniques are now rarely undertaken following blunt trauma. Endoscopic techniques (transantral and intranasal) have also been described, but these are of limited use in panfacial fractures and are therefore best used in localised nasal injuries, resulting in uncontrollable epistaxis.

20.1.5.1 Supraselective Embolisation

The use of supraselective embolisation in trauma continues to evolve and has been extensively reported to be very successful, with obvious advantages over surgery. It is now well documented as a successful treatment modality in penetrating injuries, blunt injuries, and intractable epistaxis. Catheter-guided angiography is used to first identify and then occlude the bleeding point(s). Embolisation involves the use of balloons, stents, coils, or a number of materials designed to stimulate clotting locally. Supraselective embolisation can be performed without the need for a general anaesthetic and in experienced hands is relatively quick. Its value therefore is seen in the unstable patient. Multiple bleeding points can be precisely identified and the technique is repeatable. However, immediate access to radiologic facilities and on-site expertise are essential. Complications include iodine sensitivity and, following extensive embolisation, end-organ ischaemia and subsequent necrosis. Stroke and blindness have also been reported.

20.1.6 Management of Midface Fractures

Not all patients require immediate admission. This depends on the severity of their injury. Some minimally displaced, non-mobile midface fractures are managed non-surgically, particularly in children, the elderly or those patients without any teeth. The remainder usually require treatment, either surgical reduction and repair, or intermaxillary fixation (IMF). This may be deferred a few days or a few weeks if necessary, depending on the general condition of the patient, other injuries and the extent of swelling (Fig. 20.12).

Lacerations should be inspected early for contamination and foreign bodies (do not do this with your fingers if glass could be involved). This is particularly important to prevent tattooing of the skin. Assess the viability of the soft tissues. Due to the extremely good blood supply of the face, loss of viability is unusual. Therefore tissues should not be extensively debrided or trimmed, unless it is definitely necrotic. If the facial nerve has been divided, repair should be undertaken prior to definitive wound closure. This should ideally be done as soon as possible. Facial nerve injuries occurring proximal to a line running from the lateral canthus to the angle of the mouth should be considered for microsurgical repair and urgently referred. Nerve branches lying distal to this line are often too small for repair, however this is judged on a case by case basis. If a large laceration is present, and other more urgent

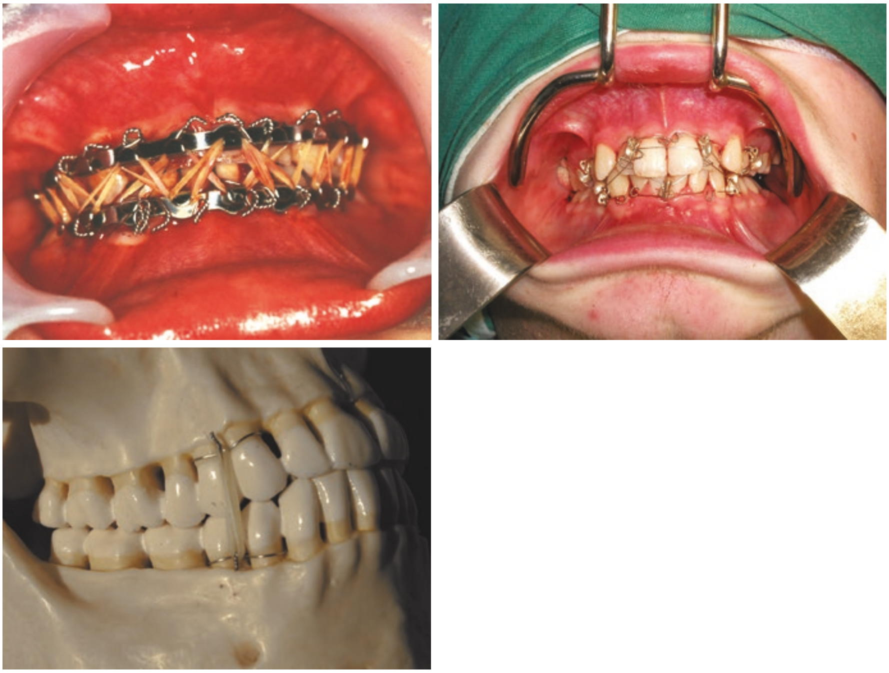


Fig. 20.12 IMF

problems need attention, tack the wound with a few large sutures and close it definitively later. If a laceration gives access to an underlying fracture, but this may not be repaired for several days, it is probably best to close the wound definitively and accept that it may be re-opened later.

Surgical repair requires meticulous attention to the buttresses. For midfacial fractures, the fracture should be treated within the first 2 weeks. Afterwards the beginning bone absorption at the fragment surfaces and the beginning callus formation leads to difficult reposition to the anatomical correct position. Repair of the buttresses is the key to successful management in midface fractures. Not only are the buttresses important in establishing the three-dimensional shape of the face, but they are often the only bones thick enough to securely support plates and screws. If the buttresses are severely comminuted and cannot be repaired, bone grafting may be required.

Today open reduction and fixation of the midface is usually undertaken in the majority of significantly displaced midface fractures. Fixation uses semirigid miniplates and monocortical screws. Under direct vision, the fractures are reduced and plated. Although intermaxillary fixation (IMF) can be used to “fine tune” minor occlusal discrepancies this must be used with care. It can only be applied if the mandible is uninjured. Furthermore, prolonged vertical traction across the midface fracture (from an unsupported mandible) can result in a slow increase in facial height if the maxilla is not fixed. This is essentially distraction osteogenesis of the fracture. If the maxilla is displaced in an edentulous patient, Gunning splints may be useful, or a new denture may be a simpler and safer option once the fracture has healed.