6 Friday Night Head and Neck Trauma

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Introduction

Trauma to the head and neck is a common occurrence in emergency departments around the world. In 2011 over 5 million emergency department visits occurred as a result of primary head and neck injuries [1]. The injuries may involve hard tissue, soft tissue or both. Radiological imaging plays an important role for most head and neck trauma patients. This chapter aims to correlate the clinical presentation with the radiological findings for facial fractures and penetrating neck injury (PNI).

Imaging Modalities

A number of imaging modalities are used to aid diagnosis following trauma to the head and neck region, but in the acute setting, these principally comprise of plain radiographs and computed tomography (CT).

Plain Radiographs

In low velocity mid-facial injuries, it may be appropriate to perform plain radiography in order to screen for mid face and mandibular fractures, and to assess the need for further CT imaging. The standard three views described for visualising mid face bony injury include an OM (Occipitomental) 10/15 degree view, OM 30 degree view and a lateral view; however, single OM 10/15/30 degree views are often employed and will identify patients with significant mid face fractures. A standard mandibular series is with an orthopantomogram (OPG) and Posterior Anterior (PA) mandible view although lateral oblique radiographs are performed if this is not available or impractical, e.g. children. Most uncomplicated zygomatic and mandibular injuries may be evaluated with plain radiography alone. Systematic search patterns (such as those described by Campbell, Trapnell and Dolan) are important in the analysis of these plain films and are traced across the radiograph to help establish the integrity of the mid face [2, 3].

Computed Tomography (CT)

The decision to perform computed tomography (CT) in the setting of mid face trauma depends on the initial clinical findings and plays an increasing role. CT is definitely indicated if there are eye signs, comminuted and displaced fractures, and clinically or radiologically suspected craniofacial or skull base fractures. There are well-described clinical features which lead the clinician to suspect such injuries and they are present in more than 50% of patients with such clinical signs [4].

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CT imaging to detect skull base and facial fractures is performed with thin sections and a bony algorithm (Figs. 6.1, 6.2, 6.3 and 6.4). Fracture detection is reported to be significantly higher with the thinnest collimation [5]. Imaging of soft tissues generally requires reconstructed thicker sections, adequate radiation dose and a soft tissue algorithm. Iodinated contrast medium may be used to help delineate vascular structures and detect arterial bleeding. In the context of high velocity facial and skull base trauma, it should always be remembered that there is potential morbidity from intracranial and cervical spine injuries, so appropriate imaging protocols should be used.

Multi-slice CT (MSCT) obtains a number of slices with each tube rotation (typically 64–256

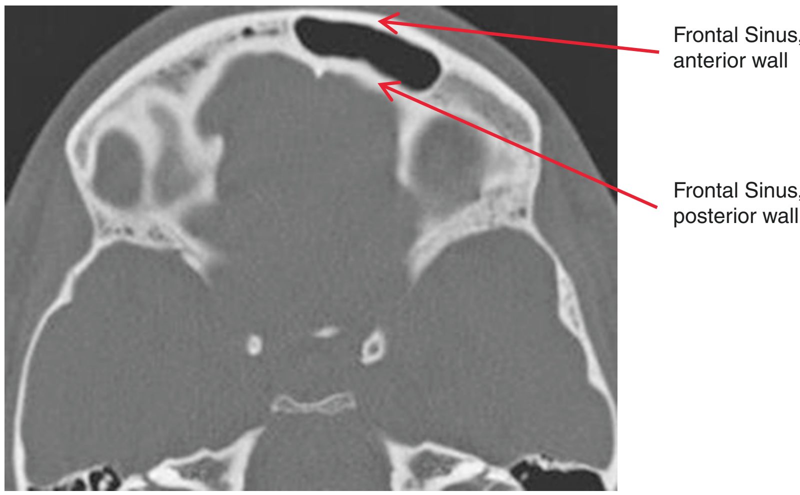

Fig. 6.1 Bone windowed, axial CT image demonstrating anatomy of the frontal sinus

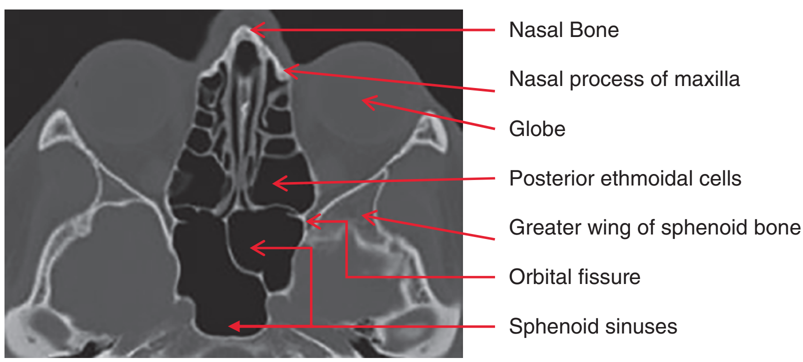

Fig. 6.2 Bone windowed axial CT demonstrating anatomy of the ethmoid sinus

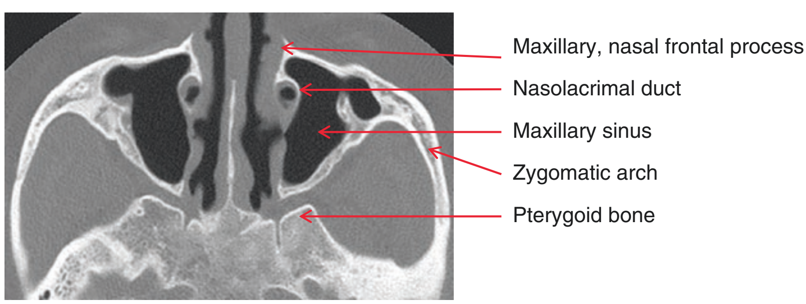

Fig. 6.3 Bone windowed axial CT demonstrating anatomy of the maxillary sinus

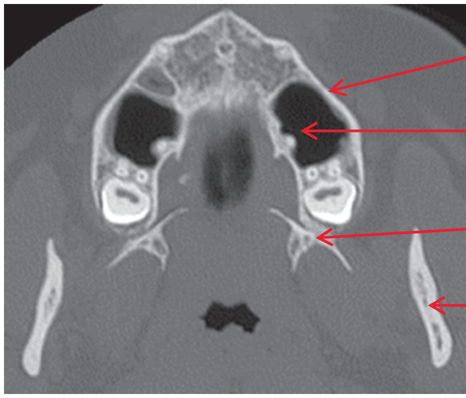

Fig. 6.4 Bone windowed axial CT demonstrating anatomy of the maxilla

slices) and so has the potential to scan larger volumes with shorter acquisition times so reducing movement artefact (e.g. due to swallowing) and optimising vascular opacification (e.g. for CT angiographic studies). It also allows the scanning of larger volumes or the use of narrower section thickness (as low as 0.3–0.5 mm) so optimising the 3D data set for post processing and 3D imaging.

Multi-planar reformats (MPRs) are routinely reconstructed and this obviates the need for direct coronal imaging, which may be problematic in the severely injured patient. Solid and transparent volume rendering (VR) techniques, as well as maximum intensity projections (MIPs) of three-dimensional objects, may also facilitate visual assessment. They may be important for surgical planning in view of the complex geometry of facial fractures.

Cone beam CT has developed as a technique which provides high-resolution bony 3D data at low radiation doses but has little role in the setting of acute trauma.

CT evaluation of the facial skeleton should also be systematic. Gentry et al. [6] described the concept of horizontal, coronal and sagittal facial planes that was based on Le Fort's earlier concept of supporting struts, and this was subsequently applied to the clinical setting by Donat et al. [7]. The extent and displacement of fractures should be delineated and key areas (e.g. frontal sinus fractures involving the frontal sinus outflow and posterior wall, or displaced orbital fractures involving the lacrimal apparatus and orbital floor) should be analysed. Adjacent soft tissue structures should also always be analysed such that masticatory, lacrimal, neurovascular and visual deficits may be anticipated.

Other Techniques

There are additional imaging modalities which are principally employed to investigate the soft tissue complications of maxillofacial and skull base injury in the subacute setting.

Angiographic techniques (conventional angiography) may be required following non-invasive CT or MR angiography, and may be used to detect vascular injuries as a precursor to endovascular therapeutic approaches. CT cisternography may be useful in the setting of constant or provoked CSF rhinorrhoea or otorrhoea, when plain CT and MRI have been unable to delineate the site of dural and bony defects. Fluoroscopic and CT studies following sialography and dacryocystography may be used to assess for damage. Ultrasound has a limited role in the high-resolution evaluation of superficial soft tissue injury of the face and orbit, and is particularly useful for the assessment of intraocular injury.

The superior contrast resolution of MRI provides excellent delineation of associated subacute intracranial traumatic sequelae as well as orbital and facial soft tissue injury. There are contraindications to the use of MRI including metallic foreign bodies in the orbit as well as many intracranial aneurysm clips, cardiac pacemakers and cochlear implants. Typical imaging sequences for face and neck imaging would include: T1W axial, T2W axial, T1W post-gadolinium axial, STIR coronal and T1 fat saturated post-gadolinium coronal images.

Head and Neck Anatomy

Epidemiology of Head and Neck Trauma

The most common aetiology of facial head and neck injuries differs depending on the geographical location. Road traffic collisions are more common in developing countries whilst interpersonal violence dominates in developed areas, with sports injuries, industrial accidents, falls and warfare constituting the remainder.

Initial Assessment

Knowledge of the mechanism of injury provides clues as to the diagnosis [8]. The force of impact, area of impact, single or multiple impacts are all important facts and provide a guide of the likely fracture pattern to expect as well as the extent of comminution. Fractures are more likely to be comminuted with high force and multiple impact injuries. Differentiation between blunt or penetrating trauma also provides information about the expected injury sustained. The medical and social history, drug and alcohol intake and any likely predisposing event, e.g. epilepsy/cardiac, are all essential information to obtain.

Advanced Trauma Life Support

Head and neck trauma patients should be managed according to advanced trauma life support (ATLS) ATLS principles.

Primary Survey

Assessment, investigations and treatment may occur simultaneously.

The priorities are:

Airway and C-spine control
Breathing
Circulation
Disability
Exposure

Head Injury High energy facial injuries are associated with a 35–40% rate of cerebral haematoma [9, 10].

The airway may be compromised due to bleeding, debris or broken teeth fragments, oedema or lack of tongue support from a fractured mandible. Bleeding can occur from injury of major vessels in penetrating neck injuries and from the maxillary artery and pterygoid plexus bleeds in mid and pan-facial fractures. Facial fractures secondary to road traffic collisions are associated with a 1–5% rate of C-spine injury [11, 12]. Zandi et al. [13] observed a 23.3% prevalence of head injury in their cohort of 2692 patients with maxillofacial trauma.

In accordance with ATLS, the priority is to deal with life threatening conditions and only once stable to deal with 'eye/sight threatening' conditions, e.g. penetrating ocular injury, primary optic nerve injury or retrobulbar haemorrhage.

Secondary Survey

Includes full maxillofacial assessment.

Facial trauma (Fig. 6.5) can be considered as injuries to the:

- Upper 1/3 (frontal basal, frontal sinus, skull base)
- Middle 1/3
- Lower 1/3 (mandible)
  OR
- Central mid face injuries (nasal, naso-orbital ethmoidal)
- Lateral mid face (zygomatic complex, orbital)
- Combined central and lateral injuries (Le Fort fractures I, II, III)
- Skull base injuries

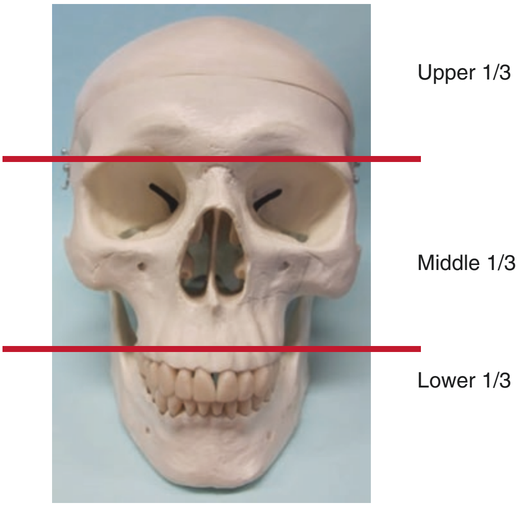

Fig. 6.5 Schematic demonstrating the classification of facial trauma

Upper 1/3 Facial Injuries (Frontal Basal)

Frontal Sinus Fracture

Case 1
A 19 year old fell onto a sharp corner of the pavement whilst under the influence of alcohol. He presented with a noticeable depression on his forehead. No paraesthesia of the forehead was noted with a full range of extra ocular movement. Visual acuity was unchanged. There was no evidence of a CSF leak or loss of consciousness. CT imaging was performed (Fig. 6.6).

Management:
- CT scan
- Options discussed:
  - 'Do nothing'
  - Reconstruction via coronal access or via an overlying laceration or endoscopic approach.

Considerations for Frontal Sinus Fractures:
- Anterior wall fracture only
- Anterior and posterior wall fracture
- Posterior wall displacement (dural breach, risk of CSF leak)

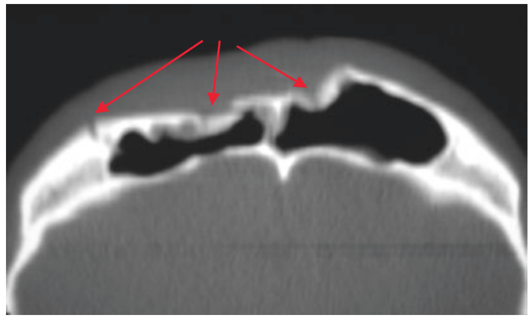

Fig. 6.6 Bone windowed axial CT image demonstrating depressed fractures involving the anterior wall of the right and left frontal sinuses. The posterior walls are intact

- Central injury (risk of frontonasal duct involvement)

The aim of management is to maintain a 'safe sinus' to reduce the risk of meningitis, mucocele, chronic sinusitis and brain abscess.

Management:
- Anterior wall alone—conservative or aesthetic reconstruction
- Displaced posterior wall +/ central injury or frontonasal duct injury for frontal sinus cranialisation and obliteration in association with neurosurgeons or endoscopic surgery.

Mid 1/3 Facial Injuries

The mid third of the facial skeleton is the portion below the skull base, excluding the mandible. It contains a number of paired buttresses (thickened bony struts) that run vertically and horizontally. Reconstruction of these is paramount following facial trauma to re-establish the facial height, width and projection.

Mid face fractures are classified according to Rene Le Fort's 1900 classification [14] (Fig. 6.7) following his experiments of direct impact on cadaveric skulls. In clinical practice, facial fractures rarely present with a pure Le fort classification injury, and as the impact force increases a 'smash' fracture pattern is frequently seen. Such pan-facial fractures are fractures of multiple facial bones involving more than 1/3 of the facial skeleton.

Case 2

A 40-year-old cyclist, went over the handlebars of his bike after a driver opened the car door into his path. He had facial abrasions, lip lacerations and he has mobility of the maxilla at the level above the tooth bearing segment. He has a fractured tooth cusp with bruising of his upper lip. His occlusion is deranged. There is no numbness of his cheek (Fig. 6.8). The CT scan findings are revealed:

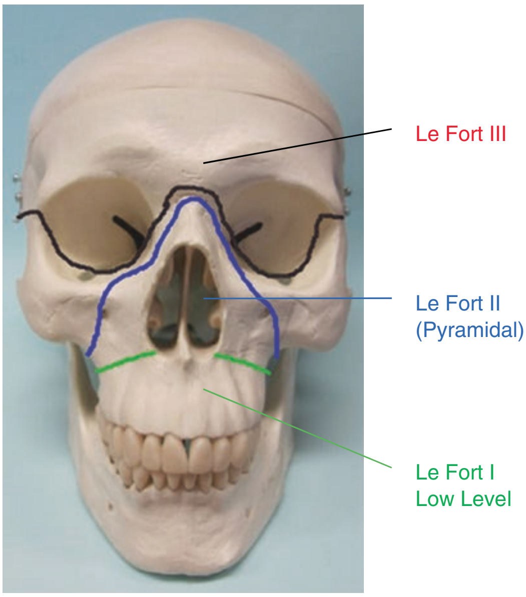

Fig. 6.7 Schematic demonstrating the 'Le Fort' classification of facial bone fractures

Management

- Upper and lower dental arch bars
- Maxillary sulcus incision
- Temporary intermaxillary fixation
- Four bone plates across the fracture (Fig. 6.9)

Case 3

A 40-year-old builder, fell from the roof of a garage (Fig. 6.10). He sustained orthopaedic injuries. His facial injuries included:

- Significant facial oedema
- Bilateral peri-orbital ecchymosis
- Epistaxis
- Deformity of the nose
- CSF otorrhoea
- Malocclusion, anterior teeth do not meet, his teeth gag onto his posterior teeth as his maxilla had been displaced posteriorly
- Mobility of the maxilla
- Step deformity at the infra-orbital rim

Imaging

- Battle sign with bruising over the mastoid (sign of skull base fracture)

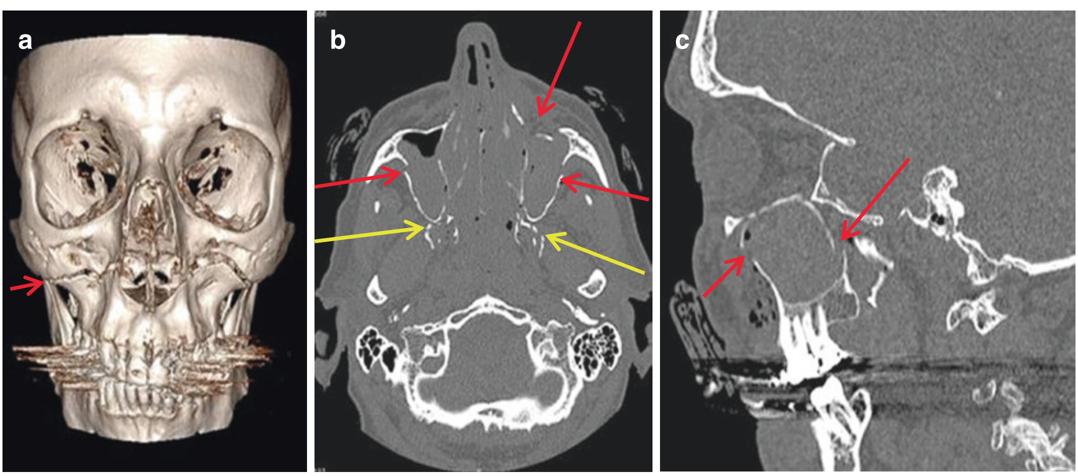

Fig. 6.8 Schematic image (**a**) and bone windowed axial (**b**) and sagittal (**c**) CT images show a Le Fort I fracture. Pterygoid plate fractures are mandatory to diagnose a Le Fort fracture (yellow arrows). There are bilateral complex maxillary antral fractures (red arrows) which included the anterolateral wall of the nasal fossa

Management

Management is based on the imaging findings of a pan-facial fracture involving the frontal sinus, Le Fort I, II and III fracture patterns, bilateral orbital fractures, naso-ethmoidal fractures and dental alveolar fractures.

Fig. 6.9 Post-op facial bone radiograph demonstrates surgical fixations

ATLS principles are followed.

The patient then proceeded to systematic reconstruction, with options including an 'Outside to Inside or Top to Bottom' approach:

- Access
- Coronal flap
- Bilateral lower eye lid incision
- Maxillary vestibular incision
- Upper and lower dental arch bars to establish correct occlusion
- Craniotomy is performed by a neurosurgeon
- Cranialisation/obliteration of the frontal sinus (bone and peri-cranial flap)
- Open reduction internal fixation of the above fractures

This patient developed an infected craniotomy hence the cranial bone flap was removed, with subsequent delayed titanium cranioplasty reconstruction (Fig. 6.11). A post-operative check is also performed for a retrobulbar haematoma.

Nasal Fracture

This is the most common facial fracture in both adults and children. It is the most prominent projection of the face and as such is most likely to be subjected to trauma. Nasal fractures may

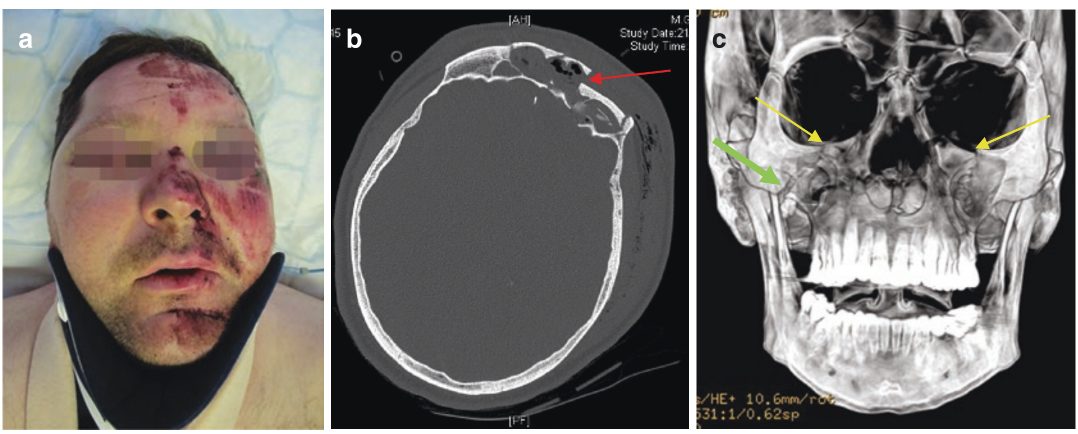

Fig. 6.10 A 40-year-old patient sustained a fall with facial injuries (**a**). Bone windowed axial (**b**) and 3D reconstruction (**c**) CT images demonstrated a comminuted frontal bone fracture with involvement of the frontal sinus' anterior and posterior walls (red arrow). There were also bilateral orbital floor (yellow arrows) and medial wall fractures, maxillary fractures (green arrow), dental alveolar fractures and a left mandibular condyle fracture. There was also a temporal bone fracture with disruption of the ossicles

Fig. 6.11 3D CT image showing cranial defect requiring subsequent cranioplasty

occur in isolation but commonly are associated with other facial bone fractures. The history will provide an indication of the injury (Fig. 6.12).

Clinical Features:
- Deformity of the nasal bone
- Oedema and ecchymosis of the nose
- Epistaxis
- Septal cartilage displaced
- Bilateral peri-orbital ecchymosis
- Mobility/Crepitus on palpation
- Nasal obstruction

Look for a septal haematoma—untreated this may result in septal necrosis and a saddle nose deformity.

Imaging
Imaging is not often necessary. History and clinical examination is the preferred method of detection of an isolated nasal fracture. A study by Clayton and Lesser [15] concluded that examination under anaesthesia was more accurate than plain radiographs. Nasal fractures are commonly associated with other facial injuries including naso-orbital ethmoidal fractures and maxillary fractures. As such, CT imaging will demonstrate the nasal injury with concurrent additional facial bone fractures.

Management of nasal bone fractures is non-urgent (ideally within 12 days) but identification of a septal haematoma with immediate drainage is necessary. Of note, the patient must be warned about the potential need for a delayed septoplasty.

Zygomatic Fracture

In a zygomatic complex fracture, disruption occurs at the frontozygomatic suture, infraorbital margin through the zygomatico-maxillary suture (buttress) and zygomatico-temporal suture. The fracture also passes through the zygomatico-sphenoid suture which is not visible on OM radiographs (Fig. 6.13), hence this is referred to as a tripod fracture. Isolated zygomatic arch fractures also occur and are easily visualised on OM radiographs (Fig. 6.13).

Clinical Features:
- Depression/flattening over the zygoma (malar)
- Peri-orbital ecchymosis/lateral subconjunctival haemorrhage
- Step and tenderness at the infra-orbital margin/frontozygomatic suture
- Paraesthesia in the distribution of infra-orbital nerve
- Limitation of mouth opening due to displacement of the zygomatic arch, with impingement on mandibular movement
- Enophthalmos
- Diplopia/entrapment of the inferior rectus muscle
- Bruising in the buccal sulcus

Imaging

Management
- Imaging

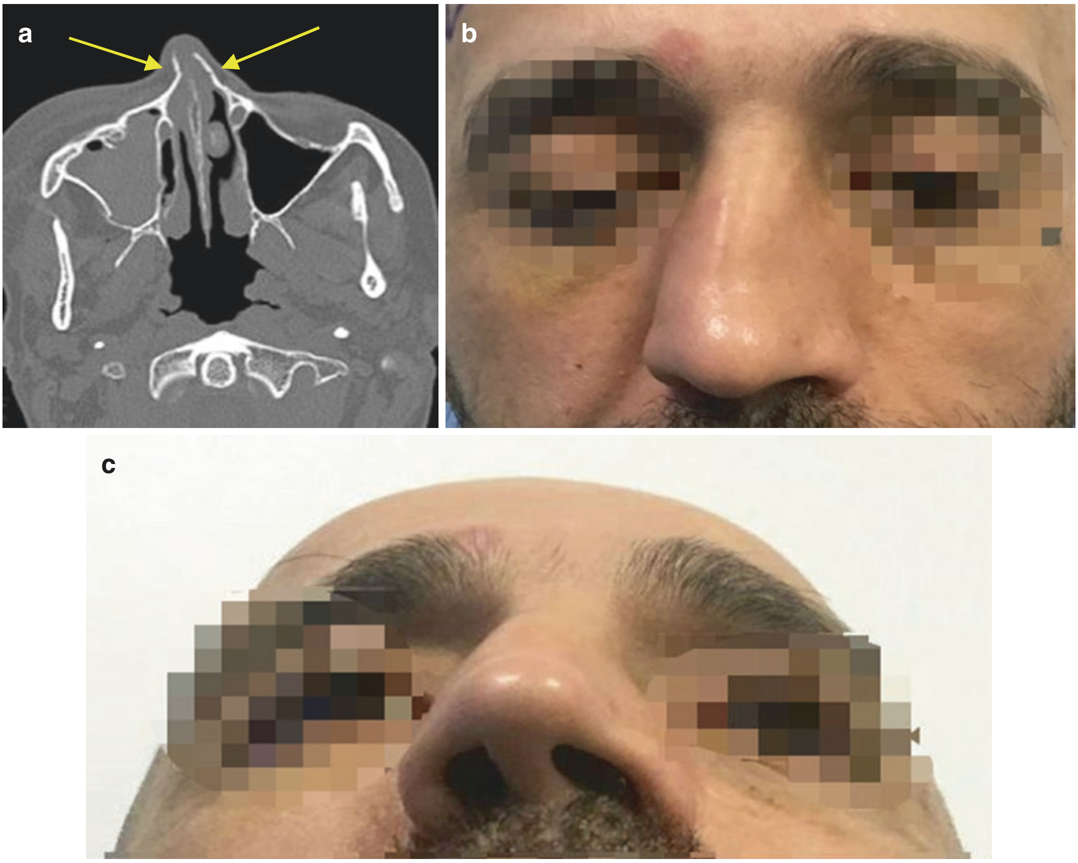

Fig. 6.12 Bone windowed axial CT image (**a**) and clinical photography images (**b**, **c**) of a nasal fracture with right-sided nasal bone deviation

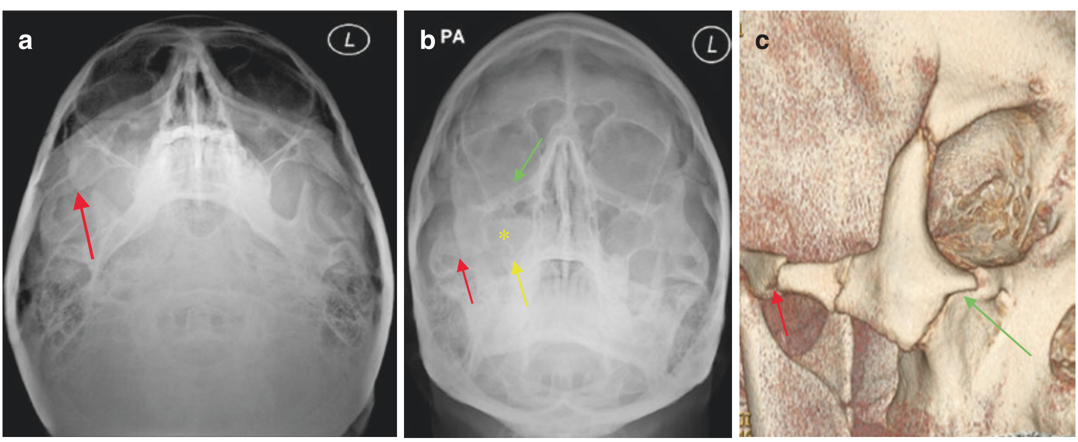

Fig. 6.13 Plain radiograph OM views 10 degrees (**a**) and 30 degrees (**b**) and 3D reconstructed CT image (**c**) showing a right zygomatic complex fracture. There is a right zygomatic arch fracture (red arrow), right orbital floor (infra-orbital rim) fracture involving the zygomatico-maxillary suture (green arrow) and right maxillary antral floor (yellow arrow). A right maxillary sinus fluid level is suggestive of associated haemorrhage (*)

- If diplopia is present, arrange for orthoptic/ophthalmic assessment (with visual fields)
- Conservative management if there are no functional (diplopia, trismus) or aesthetic concerns
- Closed reduction Gillies lift, bone hook
- Open reduction at one, two or three sites (frontozygomatic suture, infra-orbital margin, maxillary buttress) depending on the degree of displacement.

Red flags:

Retrobulbar haemorrhage presents with:

- Pain
- Proptosis
- Ophthalmoplegia
- Loss of direct light reflex

  This requires urgent surgical decompression.

Orbital Fracture

These are common injuries and form 36% of all facial injuries [16], both as isolated injuries and in conjunction with other facial fractures, e.g. naso-orbital ethmoidal fractures. A classic 'drop sign' (Fig. 6.14) can be seen on plain radiographs due to herniation of retro-ocular soft tissue into the maxillary antrum. However CT is the most common imaging modality for delineation of the bony fracture.

Imaging

Case 4

A 22-year-old male was playing cricket and was hit in the right eye with a cricket ball. On clinical examination there was a peri-orbital haematoma but with normal visual acuity (Snellen chart) although this was assessed with difficulty due to the associated swelling. There was diplopia on upward gaze and numbness in the distribution of inferior orbital nerve. CT imaging was performed (Figs. 6.15 and 6.16):

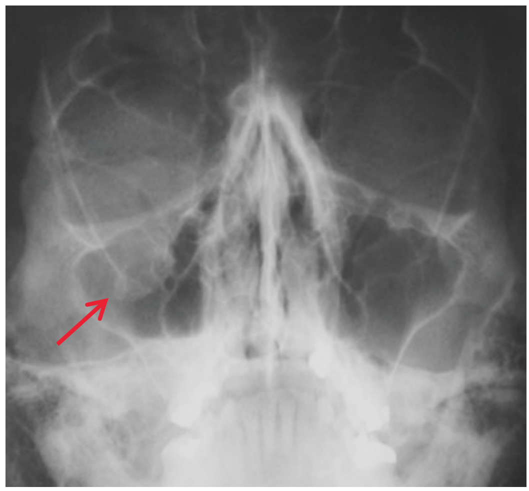

Fig. 6.14 Plain radiograph OM view 30 degrees with a right orbital floor fracture which is poorly delineated but with a 'drop sign' (red arrow)

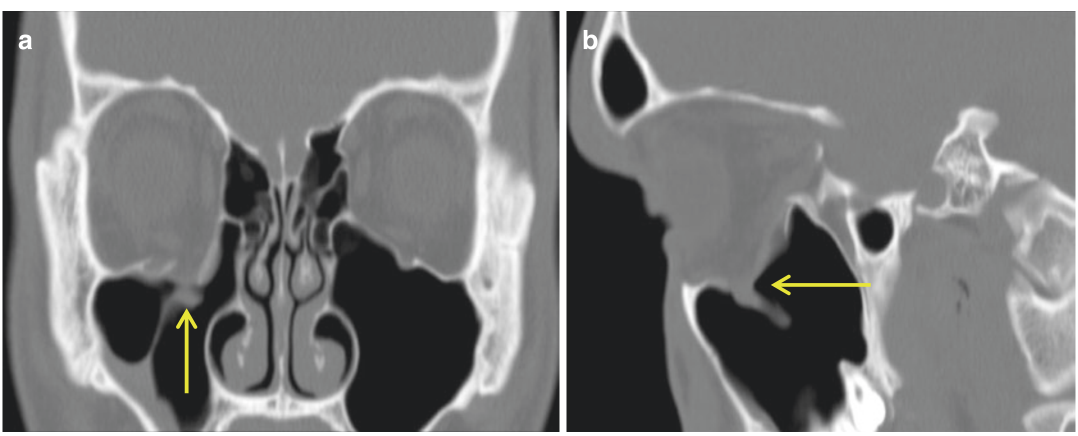

Fig. 6.15 Bone windowed coronal (**a**) and sagittal (**b**) CT images show a right orbital floor 'blow out' fracture with soft tissue herniation into the maxillary antrum (yellow arrow)

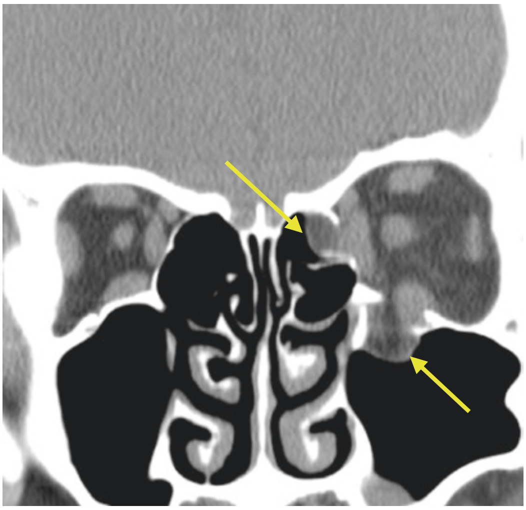

Fig. 6.16 Soft tissue windowed coronal CT image of a different patient demonstrating a left medial orbital wall and orbital floor fractures. There is herniation of the left orbital fat (yellow arrows) through the fractures and with likely impingement on the left medial and inferior recti muscles. A medial wall fracture is found in 50% of orbtial floor blow out fractures [17]

Management:

- CT scan
- Orthoptic assessment
  - Visual acuity
  - Visual fields (Hess)
- Exclude globe injury
- Exploration of the orbital injury and repair of defect with preformed or custom implants.

A 'trap door' fracture pattern is seen in paediatric patients and involves an orbital floor fracture with entrapment of the inferior rectus muscle (Fig. 6.17). This classically present as a 'white eye blow out': the child is not moving their eye, but there are few clinical signs (e.g. no subconjunctival haemorrhage). The exaggerated oculo-cardiac reflex can be mistaken for a head injury (hypotension, bradycardia, vomiting). This needs urgent treatment to avoid damage to the inferior rectus muscle.

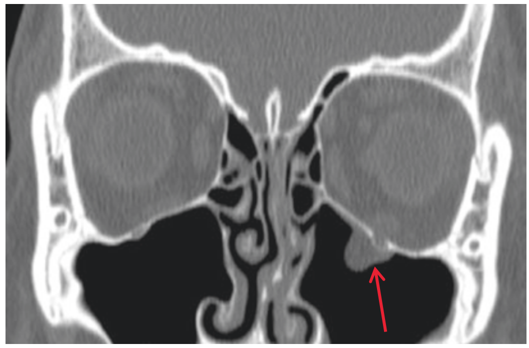

Fig. 6.17 Bone windowed coronal CT image of another patient with a left orbital floor 'trap door' fracture (red arrow) which involves the inferior rectus muscle

Lower 1/3 Facial Injuries

Mandibular Fracture

The mandible is the second most common facial fracture following nasal injuries. The history of the event, i.e. the force and location of impact will aid the location of the likely fracture. Fall onto the chin often results in a 'guardsmen's fracture'; symphyseal fracture with associated condylar fractures. Interpersonal violence is likely to result in a bilateral angle and parasymphyseal fracture pattern [18]. All fractures of the mandible involving the teeth bearing portions are compound. The higher the impact force, the more likely the fracture is to be comminuted (Fig. 6.18).

Case 5

A 26-year-old intoxicated male was punched to the jaw. He has a step between his teeth, his occlusion is deranged and he is occluding prematurely on the right side. There is a sublingual haematoma but no numbness of his lower lip. Imaging findings are showed in Fig. 6.19.

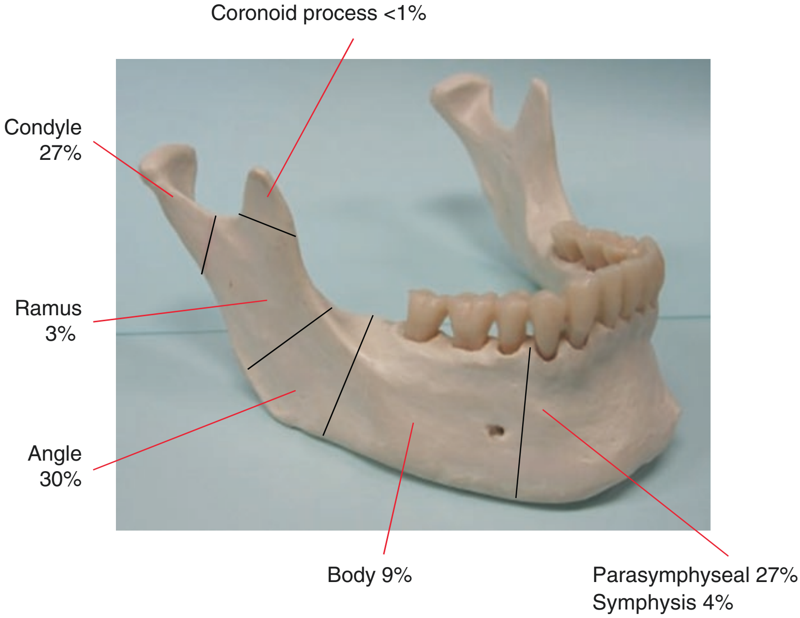

Fig. 6.18 Schematic image demonstrating the anatomy of the mandible with the frequency of common fracture sites [18]

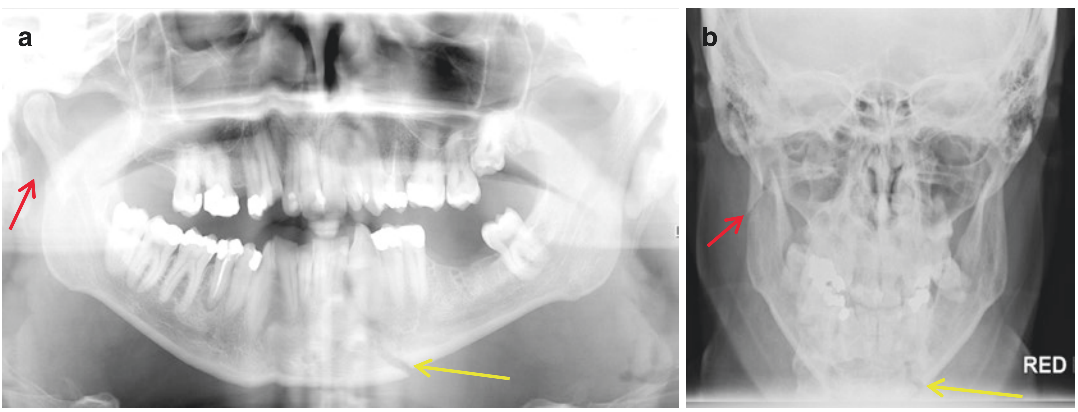

Fig. 6.19 Plain radiographs with an OPG (**a**) and PA mandible view (**b**) demonstrate a fracture of the right mandibular condyle (red arrow) and a left parasymphyseal fracture (yellow arrow)

Management:

- Open reduction and internal fixation (ORIF) of both fractures
- One plate above and one plate below the mental nerve (parasymphysis) (Fig. 6.20)
- Discuss the risk of facial nerve injury and sialocele formation (condyle)

Clinical Features of a Fractured Mandible

- Facial swelling
- Laceration on the chin (consider condylar and symphyseal fracture patterns)

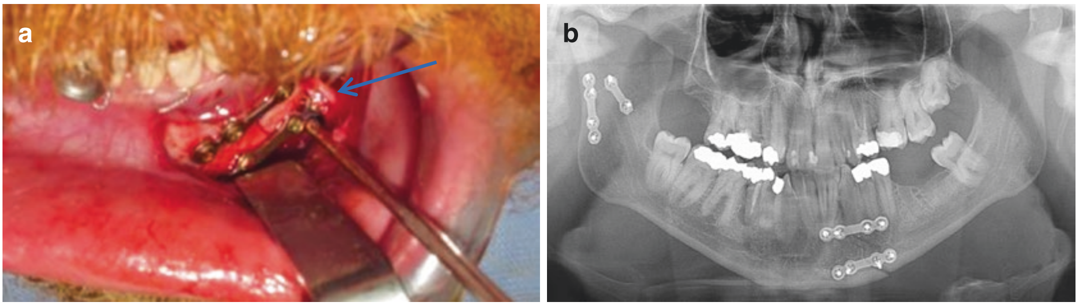

Fig. 6.20 Image (**a**) demonstrates an intra-operative photograph demonstrating the mental nerve (blue arrow). Post-operative OPG radiograph (**b**) shows the left symphyseal fracture with plates above and below the left mental nerve and two plates at the right condylar fracture

- Gingival laceration/tear at the site of the fracture
- Deviation of the mandible on opening (often deviates to the side of the condylar fracture)
- Change in occlusion/step between teeth
- Sublingual haematoma
- Altered sensation (lip/chin region) due to injury to the inferior alveolar nerve (mandibular division of the trigeminal nerve)
- Movement at the fracture site

Bleeding in the external auditory canal from condylar fractures must be distinguished from middle ear bleeds from petrous temporal bone fractures with associated CSF otorrhoea.

If a unilateral fracture is seen, then a second review is recommended as injuries are often bilateral.

Management

- Conservative management is an option in cases of unilateral, undisplaced fractures of the mandible without occlusal disturbance. Advise soft diet and review in clinic.
- Closed reduction entails the use of intermaxillary fixation (wiring between the upper and lower jaw).
- Majority of cases undergo open reduction internal fixation.

CT scans (conventional and CBCT) are utilised for more complex fracture patterns or when there are other associated fractures.

Advantage:

- Polytrauma assessment
- Complex fracture patterns can be better characterised
- 3D formatting

Disadvantage:

- Scatter from dental restoration

Skull Base Fractures

The skull base is made up of the following bones: cribriform plate of ethmoid, orbital plate of frontal bone, temporal, sphenoid and occipital bones. Temporal bone fractures are the most common (Fig. 6.21). Clinical signs include:
'Battle sign' mastoid ecchymosis: appears day 1–3
Peri-orbital ecchymosis
Rhinorrhoea or otorrhoea
Haemotympanum

There is a risk of hearing loss, facial nerve injury and fistulous complications, e.g. CSF leak and peri-lymphatic fistula. Clinical assessment

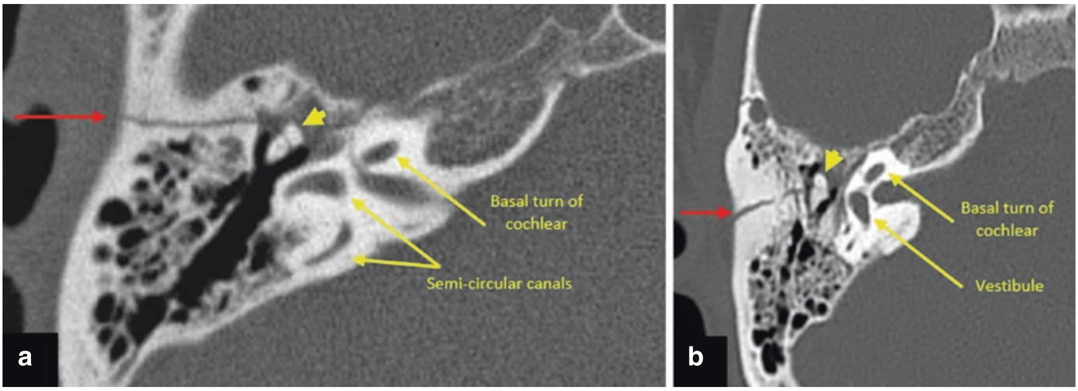

Fig. 6.21 Bone windowed axial CT images through the temporal bone of two different patients (**a**, **b**). Both demonstrate a longitudinal fracture through the right petrous temporal bone (red arrow). Longitudinal fractures run parallel to the long axis of the petrous temporal bone. Normal appearances noted of the bony labyrinth (labelled) including the articulation of the head of malleus with the body of incus (arrow head)

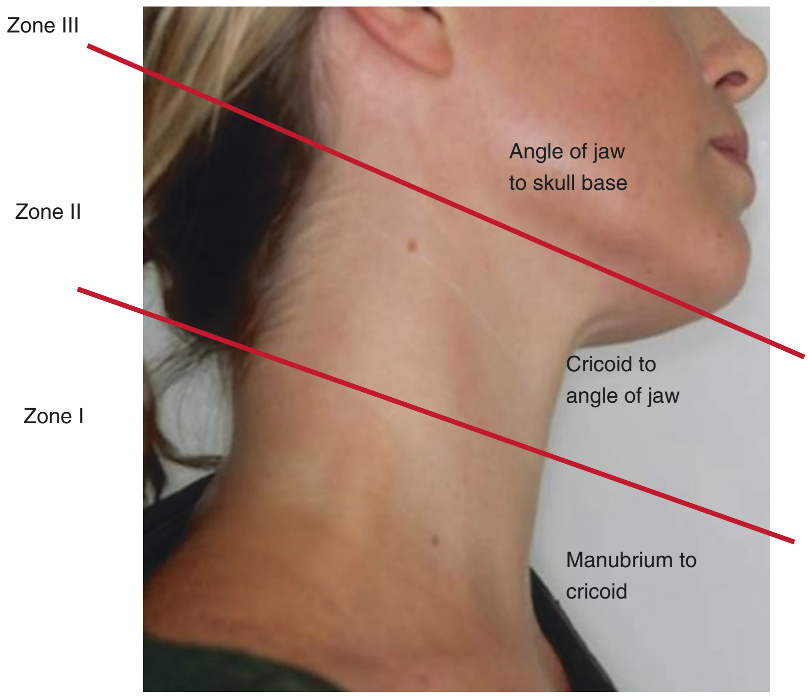

Fig. 6.22 Schematic image demonstrating the Monson classification of penetrating neck injuries

for protein, glucose and Beta 2 transferrin to confirm the presence of CSF should be performed.

Imaging

Penetrating Neck Injury

Penetrating neck injuries (PNIs) are on the increase and can quickly become fatal. There are multiple vital structures that need to be considered: major vessels, larynx, trachea, lung, oesophagus, spinal cord and nerves. Approximately 10% of patients present with airway compromise through laryngeal or tracheal injury [19, 20]. As such, a structured assessment, imaging and treatment pathways are essential. The Monson neck classification of penetrating injuries is most frequently used (Fig. 6.22). The majority of PNI cases affect Zone 2. There is no

Table 6.1 Suggested protocol for direct to theatre for patients with PNI

Assess ABCDE

Definitive airway if need

↓

Control Haemorrhage

Direct pressure / Foley Catheter in wound

↓

Unstable Patient

Straight to theatre* No Imaging

↓

Deep Injury but stable – CT Angiogram

*Straight to theatre (Hardsigns):

- Shock
- Pulsatile Bleeding
- Expanding Haematoma
- Unilateral extremity pulse deficit
- Audible bruit of palpable thrill
- Airway compromise
- Extensive subcutaneous emphysema
- Stridor
- Respiratory distress
- Signs of stroke/cerebral ischaemia

international consensus guideline [21]. Table 6.1 is our local standard operating policy for PNI.

Case 6

A 55-year-old male was held by an assailant from behind and sustained a 10 cm midline laceration across the anterior neck. The patient remained awake, alert and maintaining his airway but with a change in his voice with bubbles and gas escaping from his wound and extensive surgical emphysema. Venous bleeding was also noted from the wound; the patient remained haemodynamically stable (Fig. 6.23).

Imaging

A CT angiogram (CTA) was performed which demonstrated extensive soft tissue injury, surgical emphysema with likely laryngeal penetration and pools of blood in the venous phase suggestive of possible bleeds from branches of the external carotid artery.

Management:

- Level II penetrating neck injury
- Airway aerodigestive tract assessment: airway patent and likely laryngeal injury
- CT Angiogram performed

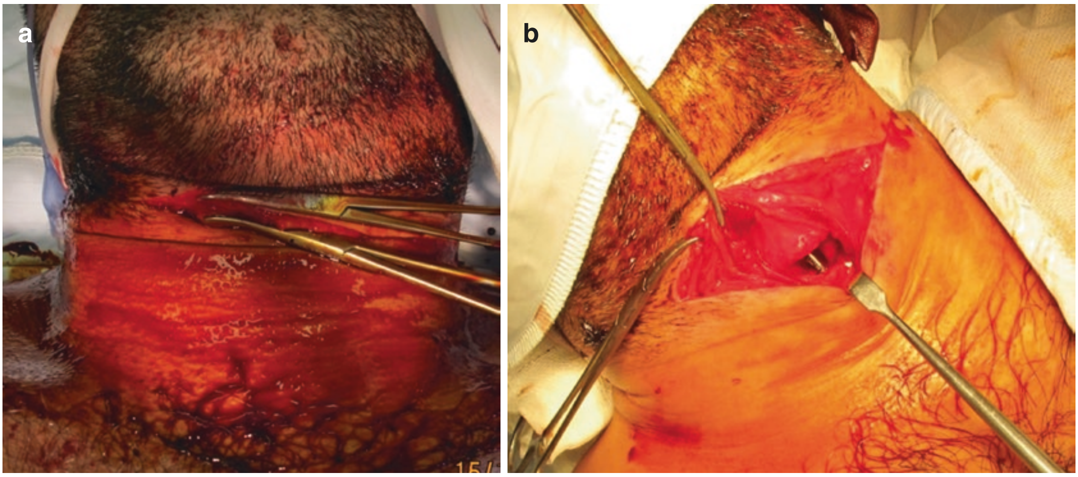

Fig. 6.23 Intra-operative photographs of a 55-year-old male after sustaining a penetrating neck injury (**a**, **b**)

- Exploration of wound, 120 degree transection of larynx
- Consider Tracheostomy
- Repair of cricothyroid membrane
- Nasogastric tube placement
- Interval fibre optic laryngoscopy assessment for vocal cord function

Case 7

A 19-year-old male was attacked with a broken bottle. The entry wound was 2 cm with the platysma breached. Venous bleeding was noted. The patient maintained his airway and was haemodynamically stable (Fig. 6.24).

Imaging

Management:

- CT angiogram (Fig. 6.25)
- Exploration under general anaesthesia
- Extension of the wound to allow identification of the source of bleeding. Small entry wounds require enlargement to enable exploration

Fig. 6.24 Photographic image of a 19-year-old male demonstrating a sharp neck trauma

Summary

Management of facial trauma is multidisciplinary and requires the input from different teams: radiology, maxillofacial, ENT, neurosurgery, ophthalmology and vascular. In all cases ATLS principles must be followed on initial assessment. Knowledge of the mechanism of injury will provide clues as to the likely diagnosis and guide further assessment. Appropriate imaging is of paramount importance to the characterisation and subsequent management of facial and neck trauma in not only diagnosis but also sequencing of the reconstruction (Table 6.2).

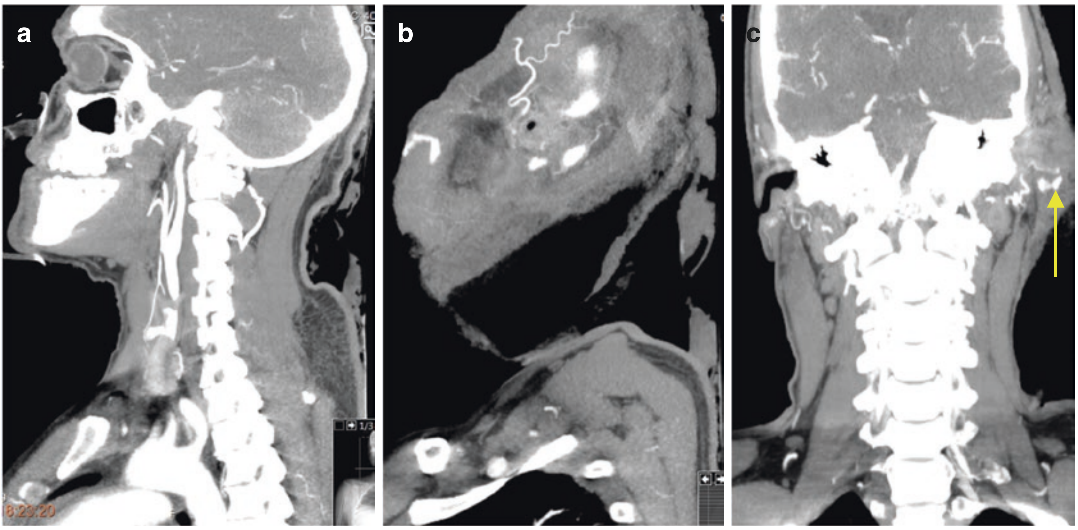

Fig. 6.25 Post contrast CT angiogram sagittal (**a**, **b**) and coronal (**c**) images demonstrating bleeding from the left posterior auricular artery (best seen on image **c**, yellow arrow)

Table 6.2 A summary of trauma imaging

Imaging technique	Area	Notes
Occipitomental (OM) radiograph at 0, 10 and 30 degrees	Zygomatic complex/arch Maxilla and maxillary sinus (e.g. fluid level)	Increasing use of CT
Orthopantomogram (OPG)/ dental pantomography (DPT)	Mandible Teeth (periapical infection)	Poor visualisation of anterior teeth due to superimposition of C-spine. Requires patient to stand upright Limited visualisation of high/ intracapsular condylar fracture Artefact, e.g. tongue shadow Increasing use of CT/CBCT for comminuted fracture mandible
Postero anterior (PA) mandible radiograph	Mandibular fracture especially condylar	Increasing use of CT/CBCT
Lateral oblique radiograph	Body, angle, condyle of mandible	Patients who cannot stand for an OPG. Young children. Rarely used and may require further imaging e.g. CT/CBCT
Computed tomography (CT)	Facial fractures (particularly if comminution, displacement, skull base extension and clinical eye signs)	Advantage in polytrauma, complex fracture patterns 3D formatting Disadvantage: Scatter from dental restoration
CT angiogram	Suspected vascular injury	

Learning Points

- Correlation between the mechanism of injury and examination findings will aid in the diagnosis
- Consider the inital best imaging modality based on clinical evaluation and the likely differential (plain film radiographs versus cross-sectional CT imaging)
- Understand that fractures often follow a pattern and may have associated soft tissue sequelae which must be excluded clinically/radiologically.
- Penetrating neck trauma is likely to warrant a CT angiogram if the platysma is breached.
- Radiology has a role in diagnosis but also in surgical planning.

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