Anaesthesia and common oral and maxillo-facial emergencies

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Maxillo-facial cases frequently present for emergency surgery and are commonly infective or traumatic in nature. These are usually first assessed by junior members of the anaesthetic and surgical teams. A thorough understanding of the potential for complications and the need for a 'whole strategy' approach in airway management is essential in achieving a successful outcome.

Head and neck infections

Despite advances in microbiology and antibiotic therapy, the treatment of head and neck infection often requires surgery. It can present with life-threatening complications such as airway obstruction, mediastinal spread, and cavernous sinus thrombosis, all of which have increased morbidity and mortality.

Pathophysiology

Odontogenic- or dental-related infections begin with decay and progress to pulpitis, which is inflammation of the nerve chamber in the centre of the tooth. Infection then spreads into the bone and causes perforation of the bone cortex into the subperiosteal region. Fascial planes of the head and neck are virtual spaces, bounded by muscle attachments and bone. The muscle attachments and fascial planes will govern in which direction the infection spreads to the soft tissue spaces. Knowledge of the orofacial musculature is needed to predict the path of infection. The commonly affected fascial spaces are illustrated in Figures 1 and 2. Infection can spread from these into the infra-temporal fossa, sub-temporalis, and parapharyngeal spaces. This describes the local or direct spread. The spread from the pre-maxillary region (soft tissue anterior to the maxilla containing the canine and part of the buccal space) can progress to orbital cellulitis. If left unchecked, this can lead to cavernous sinus thrombosis. A parapharyngeal abscess often has little clinical signs until the airway is compromised, as the swelling is intra-oral or parapharyngeal. A frequent culprit is a wisdom tooth which also causes submaseteric inflammation and trismus.

Preoperative considerations for dental abscess surgery

All patients require an appropriate and adequate preoperative assessment to define the extent of disease progression, in particular, looking for indicators of potential airway compromise, anticipated difficulties in airway management, and significant comorbidities. A history of altered speech, odynophagia, rapidly worsening swelling, and severe trismus can signify partial airway obstruction. Stridor and dysphagia are often late signs and stridor may be absent when at rest.

Careful assessment of the airway is needed using routine bedside techniques such as Mallampati score, interdental distance, and protrusion of the mandible and should include a detailed examination of the neck. The lack of tongue protrusion is a very sensitive indicator of sublingual involvement and a good indicator for a successful outcome.

Key points

Oral and maxillo-facial cases present frequently on the emergency operating list and can pose significant challenges for the anaesthetic team.

Forty per cent of cases reported to the recent NAP 4 audit were head and neck pathology.

Correct management requires early recognition and knowledge of anatomy and path of spread of infections.

Facial and neck trauma can present specific challenges for the anaesthetist.

Careful assessment and planning, effective communication, early senior involvement and appropriate back up plans are paramount for a successful outcome.
of impending airway compromise. Mouth opening can be limited by trismus. Application of the assessment findings, to help anticipate where difficulties might be encountered, for example face-mask ventilation, direct tracheal access, insertion of trans-tracheal catheter under local anaesthesia before induction, awake fibreoptic intubation or tracheostomy under local anaesthesia have been techniques described in the literature. Adequate pre-oxygenation, i.v. access, and monitoring are paramount irrespective of the technique used.

Trismus secondary to infection might not improve with induction of anaesthesia. In cases where mouth opening is limited and swelling is confined to the oral cavity, there should be a low threshold for the use of awake nasal fibreoptic intubation. In the recently published NAP 4 report, failure to consider awake fibreoptic intubation as the primary airway technique led to direct harm in a proportion of reported patients. The avoidance of muscle relaxation when a difficult laryngoscopy is also anticipated, by using either a gaseous induction or a TIVA technique led to a feeling of false reassurance and contributed to adverse outcome in some cases. This, however, should be balanced against those cases where these techniques were used successfully and so, were not included in the project. It should be recognized that all primary techniques may fail and that clear rescue plans are in place before commencing anaesthesia. The location of anaesthetic management also needs consideration. The NAP 4 report recommends the anaesthetic management of any case which may involve surgical tracheostomy as a rescue technique should start in the operating theatre.

Once a secure airway is established, anaesthesia can be maintained by either gaseous or i.v. routes. A saline-soaked throat pack is placed in the oropharynx, if possible, to absorb pus, secretions, and blood. Antibiotics are given according to local microbiology guidance. I.v. dexamethasone may also be required.

The operating table may need to be rotated to 90° or 180° with regards to the anaesthetic machine. Pain relief can be provided by paracetamol, non-steroidal anti-inflammatory drugs, intra-oral local anaesthesia, and long acting opioids.

Postoperative management

The decision to extubate post-surgery should be taken on a case-by-case basis and after discussion with the surgeon. For patients with significant swelling and stridor at presentation, it may be necessary to keep them sedated and ventilated until extubation becomes safe to do so. Some patients are likely to develop further postoperative swelling, particularly those with Ludwig’s angina or parapharyngeal involvement.
The Difficult Airway Society is currently drafting guidelines for extubation. Anticipating, planning, and preparing for what could be an equally dangerous time of anaesthesia should include checking for a ‘cuff down’ leak, having airway equipment for re-intubation on standby, appropriate anaesthetic drugs drawn up in the required doses, and a management strategy in case extubation fails. The surgical team should remain in the operating theatre until successful extubation has been established. A period of observation in theatre should follow before transfer to recovery.

Special considerations

Ludwig’s angina

Ludwig’s angina is a life-threatening cellulitis of the floor of the mouth involving both submandibular and sublingual spaces, bilaterally. It was first described in 1836 by Wilhelm Friedrich von Ludwig. A good predictor of sublingual involvement is the inability of the patient to protrude the tongue. This is related to the anatomical shape of the genioglossus muscle which is c-shaped. The concavity of the ‘c’ produces the sublingual space. When this is full (oedema or pus), the muscle cannot fold over itself, as happens in tongue protrusion.

Surgical tracheostomy is often difficult and occasionally life threatening due to the involvement of the neck and pre-tracheal tissues. Incising through the pre-tracheal fascia and exposing the pre-vertebral tissues to pathogens risks the spread of infection into the mediastinum. Mediastinitis, despite modern healthcare, still carries significant mortality.

Facial trauma

The face is a complex apparatus, giving us the ability to eat, speak, smell, hear, see, and interact socially. Facial injuries can be life threatening, by compromising the airway and causing significant blood loss.

Epidemiology

The most common causes of facial injuries in the UK are:

- interpersonal violence (52%),
- road traffic accidents (16%),
- sports injuries (19%),
- falls (11%),
- industrial accidents (2%).

In a BAOMS survey of the UK facial injuries in 1997, the male-to-female ratio was 2:1 overall. The mean age was 25.3 years. Facial fractures have associated soft tissue injuries and dental injuries. Traumatic brain injury occurs in 15–48% of patients with maxillo-facial trauma. The incidence of cranio-maxillo-facial injuries initially decreased after basic road safety measures (seat belts, motor cycle helmets), but has increased again due to interpersonal violence.

Anatomical considerations

The facial skeleton is composed of many bones inter-digitating with each other at suture lines. It is designed to perform several
functions but in the context of trauma, they act as a crumple zone to evenly distribute energy transferred to the face whilst minimizing damage occurring to the skull and brain. There are natural points of weakness in the facial skeleton as well as areas of very strong dense bone called buttresses (Fig. 3). Facial fractures occur in characteristic points where the bones are weakest, and when the buttresses break, it is less usual for the break to be comminuted. Comminution implies greater energy transfer. There are further points of weakness where the facial bones are penetrated by vital structures forming ‘holes’ in the bony cortex. An example of this is the infra-orbital foramen carrying branches of maxillary nerve (second branch of trigeminal nerve, V₂) and infra-orbital vessels.

The tongue is tethered forward to the mandible by the paired genioglossi muscles that insert into the genial tubercles on the lingual aspect of the anterior mandible (symphysis). Bilateral anterior fractures of the mandible may cause the tongue to fall back into the oropharynx and a conscious patient with this injury will sit up and forwards to protect his own airway. In an unconscious supine patient without airway protection, this fracture is fatal.

The face has an extremely good blood supply and facial fractures, particularly of the mid-face, can cause catastrophic haemorrhage. A significant portion of this may go unnoticed in an unconscious supine patient as it can accumulate in the airway, pharynx, and stomach.

**Basics of energy transfer**

Energy transfer is an important concept to explain when dealing with any form of trauma. It is now understood that the total force is not as important as the amount of energy transferred into the tissues, which is directly proportional to the level of tissue damage that will occur. This is most easily exemplified in ballistic trauma. A sniper’s bullet travelling greater than the speed of sound will hit the face and pass through it causing a minimal damage. A handgun fires a bullet at much lower speed but the bullet often does not exit the tissues. All of the kinetic energy in the handgun bullet is therefore transmitted to the tissues, leading to more extensive damage.

**Classification**

**Fractures of the lower third**

The lower third of the face is made of the mandible and its teeth. The mandible forms a ring with the temporo-mandibular joint and the base of skull. A ring is difficult to break in only one place and therefore the mandible often fractures in two or more places. Frequently, these are in different places on each side and this has generally little impact on the airway, unless there is gross displacement or bilateral anterior fractures (Fig. 4). Gross displacement causes bleeding that can cause a large sublingual haematoma in effect reproducing the airway compromise of Ludwig’s angina. As the roots of teeth act as a natural weak point in the mandible, teeth are often in the fracture line and can become displaced, loosened, or avulsed.

**Fractures of the middle third**

The mid-face is made up of the maxilla, zygoma, and lower half of the naso–orbito–ethmoidal complex. This part of the face houses the eyes, the nasal airway, maxillary sinuses, and maxillary teeth. The mid-face acts as the crumple zone to protect the brain from injury and is frequently involved in facial injuries. As complex mandibular injuries can result in airway compromise, so can middle third fractures. Importantly, these can result in significant haemorrhage and immediate life-saving measures may involve placement of Epistats, Rapid Rhinos™, Foley catheters, or equivalents and bite blocks such as McKesson’s to splint the maxilla and tamponade bleeding points.

Le Fort fractures (Fig. 5) are common patterns of injury. It must be borne in mind that these patterns were produced on cadavers and do not occur so precisely in vivo.
In Le Fort I, the maxilla is fractured from the rest of the face and is often not as freely mobile as one might expect. Only in high energy transfer does the maxilla become loose and at risk to the airway. Le Fort II involves the maxilla and nasal complex fracturing from the facial bones and mobility is often more than Le Fort I. Le Fort III injuries are more significant and involve the whole mid-face dissociating from the base of the skull and facial bones. Frequently Le Fort injuries will occur in combination and involve the mandible.

**Fractures of the upper third**

The upper third is made of the frontal bone, sphenoid and upper half of the naso–orbito–ethmoidal complex. It contains the eyes and more of the paranasal sinuses (frontal, anterior and posterior ethmoids, and sphenoids). The frontal bone’s weakness is the frontal sinus and the extent of pneumatization varies considerably between individuals. When the sinuses are large, the frontal bone may fracture and involve the anterior skull base. These fractures may be associated with dural tears, cerebrospinal fluid leak and, therefore, the risk of ascending infection.

Upper third fractures are of consequence to the anaesthetist because it is commonly necessary for tubes to be placed into the nose (Foley catheters, nasogastric tubes, and temperature probes). Due to fracture displacement and difficult clinical circumstances, they can end up in the frontal lobe. There is no absolute contra-indication for placement of these tubes in anterior skull base trauma. These fractures may be associated with dural tears, cerebrospinal fluid leak and, therefore, the risk of ascending infection.

**Preoperative considerations for maxillofacial trauma surgery**

This article excludes those patients who have already been intubated for definitive airway control as part of the ATLS primary survey. It assumes an adequate general preoperative assessment and should follow similar principles as outlined in the previous section for dental abscess surgery.

For the ward patient with isolated facial trauma, airway assessment should include the inspection of swelling, nasal patency, mouth opening, and Mallampati scoring. Trismus is often caused by pain and can disappear on induction of anaesthesia. However, it may persist for mechanical reasons and this needs to be discussed with the surgical team. Preoperative imaging should be reviewed. The route of repair also needs consideration, as it can be intraoral, subconjunctival or via a scalp flap. Different tracheal tubes (TTs) may be used: south facing oral R.A.E™ for zygomatic or orbital fractures, nasal for other fractures including mandibular, Le Fort fractures or any that involve malocclusion. Alternatives to oral intubation include tracheostomy or submental intubation. The need for a throat pack, postoperative intermaxillary fixation, and facial nerve monitoring should also be discussed.
Anaesthetic technique

The choice of anaesthetic technique will again be influenced by the airway evaluation and the difficulties anticipated. Blood in the airway can make some techniques more challenging and therefore vigilant planning and decision-making is necessary (see Table 1). Senior involvement is recommended.

Pain can decrease after fixation of fractures. The surgeons infiltrate local anaesthetic with vasoconstrictors during the procedure and paracetamol, non-steroidal anti-inflammatory drugs and long-acting opioids can be used in combination. I.v. dexamethasone is administered to decrease swelling, followed by subsequent doses for the first 48 h. Antibiotic prophylaxis is indicated in wounds with gross contamination, orally penetrating wounds, exposed cartilage, and devascularized wounds.8

The anaesthetist needs to be aware of and prepare for potential intra-operative complications. Reflex bradycardia during levering of a zygomatic fracture or manipulation of the mid-face can occur. This can be treated with anticholinergics such as atropine. Blood loss from facial fractures can be extensive and a large bore cannula, fluid replacement, and a recent group and save sample is a basic requirement. Other complications include TT damage, oculo-cardiac reflex, and wiring of the TT to the maxilla.9

Postoperative considerations

Extubation should be planned as prudently as intubation, bearing in mind that the degree of oedema can worsen in the first 48 h after the injury. This is especially true in the case of Le Fort II and III fractures. Throat packs should be removed at the end of the operation and the oropharynx suctioned for debris and clots. Wire cutters or scissors for elastic band fixation should be immediately available. Extubation should occur when the patient is fully awake, and emergency intubation drugs and airway equipment are instantly to hand. The surgical team should be in attendance until successful extubation has occurred.

Due to residual swelling, some patients may be admitted to a high dependency unit for close observation. Those that remain intubated and ventilated are sent to the intensive care unit.

Postoperative haematoma

Haematoma formation in the early postoperative period is an uncommon, but potentially airway-threatening complication of some maxillofacial operations, notably neck surgery, thyroid resections, and floor of mouth surgery.

The rate at which airway compromise occurs is variable. Emergency decompression of the haematoma by removing the clips/sutures and manually evacuating the haematoma with a Yankaur sucker may not alleviate the airway obstruction adequately due to oedema that results from venous congestion. The method of securing the airway should take into consideration information from the initial operation but it is expected to be more challenging and warrant expert participation.

Conclusions

Anaesthesia for common oral and maxillofacial emergency cases can present significant challenges to the anaesthetist. They can often be patients who are previously fit and well but who now have ‘temporarily’ difficult or compromised airways. No ‘one size fits all’ method is possible and careful assessment and planning, effective communication, and early senior involvement are paramount to a successful outcome. The NAP 4 project highlights that ‘Plan A’s’ can and do fail. Well thought through back up plans are essential to the airway management strategy, in these cases.

Declaration of interest

None declared.

References

10. Assael LA, Klotch DW, Manson PN et al. Manual of Internal Fixation in the Cranio-Facial Skeleton, Le Fort I-III Fractures. Springer, 1997; p109, Fig. 4.2.1

Please see multiple choice questions 21–24.