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Airway Management Strategies In Pan Facial Fractures: A Comprehensive Review

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Abstract

Pan facial fractures represent one of the most challenging scenarios in trauma and reconstructive surgery. In addition to complex skeletal disorganization, surgeons and anaesthesiologists must address life-threatening airway compromise. The decision regarding airway management is critical, as it directly influences surgical access, patient safety, and long-term outcomes. Conventional orotracheal and nasotracheal intubation techniques are often precluded due to fracture patterns, cerebrospinal fluid leaks, or the need for intraoperative maxillomandibular fixation. Over the past three decades, alternative strategies such as submental intubation, submandibular intubation, tracheostomy, and fibreoptic techniques have evolved to address these unique needs. This review consolidates current evidence on airway management strategies in pan facial fractures, examining indications, technical considerations, complications, and outcomes. Algorithmic approaches are proposed to guide clinical decision-making, while highlighting innovations such as ultrasound-assisted techniques.

Keywords: Pan facial fractures; Airway management; Submental intubation; Tracheostomy; Fibreoptic intubation; Maxillofacial trauma; Difficult airway.

Introduction

Pan facial fractures involve simultaneous disruption of the upper, middle, and lower facial thirds. They typically result from high-energy trauma such as motor vehicle accidents, assaults, or ballistic injuries, and are frequently accompanied by airway compromise due to haemorrhage, oedema, or distortion of skeletal and soft tissue landmarks [1]. Effective airway management is the first and most critical step in the treatment of these patients, ensuring oxygenation while facilitating surgical exposure for fracture repair.

The challenge arises because standard airway techniques—such as orotracheal or nasotracheal intubation—may obstruct surgical access or be contraindicated due to concomitant injuries. For instance, nasotracheal intubation is avoided in suspected basilar skull fractures, while orotracheal intubation obstructs occlusal evaluation and maxillomandibular fixation. Tracheostomy, once considered the default solution, carries risks of early and late complications. Submental intubation and its modifications have therefore emerged as attractive alternatives in select patients.

This article provides a comprehensive review of the current literature on airway management in pan facial fractures, analysing the evidence supporting each modality and proposing an evidence-based algorithm for practice.

Epidemiology and Challenges

The incidence of pan facial fractures is rising in developing countries due to road traffic accidents, while interpersonal violence is a dominant cause in urban centres [2]. Airway obstruction is a major cause of early mortality. Haemorrhage from the nose, mouth, or pharynx; tongue prolapse due to bilateral mandibular fractures; and aspiration of blood or vomitus compound the challenge [3].

The airway must be secured quickly in emergency settings, yet in definitive surgical repair, airway choice must balance surgical access, safety, and potential morbidity. A multidisciplinary collaboration between anaesthesiologists, maxillofacial surgeons, and otolaryngologists is essential.

Airway Management Strategies

Orotracheal Intubation

Orotracheal intubation is usually the first method attempted in trauma settings. It is fast, familiar, and requires minimal equipment. However, in pan facial fractures, orotracheal intubation obstructs intraoperative occlusal assessment and may interfere with reduction and fixation of mandibular or maxillary fractures [4].

Intraoperative switching from orotracheal to nasotracheal or submental approaches has been described but requires careful planning to avoid hypoxia and contamination [5].

Nasotracheal Intubation

Nasotracheal intubation offers unrestricted access to the oral cavity and is often preferred in orthognathic surgery. However, in pan facial fractures with Naso ethmoidal complex disruption or suspected skull base fractures, nasotracheal intubation risks intracranial tube placement and meningitis [6]. Thus, it is contraindicated in many panfacial trauma cases.

Submental Intubation

First described by Altemir in 1986, submental intubation (SEI) provides an elegant solution by exteriorizing the endotracheal tube through a small submental incision, thereby avoiding both oral and nasal routes [7]. Numerous prospective and retrospective series confirm its safety and efficiency.

- **Procedure:** A small midline or paramedian incision is made in the submental region, followed by blunt dissection into the floor of the mouth. The proximal connector of the tube is detached, passed through the tunnel, and reconnected externally.
- **Advantages:** Provides intraoperative occlusal control; avoids tracheostomy morbidity; relatively quick (<10 minutes in experienced hands) [8].
- **Complications:** Include superficial infection, salivary fistula, scarring, accidental extubation, and rare lingual nerve injury. However, complication rates are consistently low [9].
- **Modifications:** Ultrasound-guided placement, Seldinger technique, and use of Griggs forceps have been introduced to improve precision [10].

Submandibular Intubation

A variant of SEI, submandibular intubation involves a lateral incision beneath the mandible, potentially reducing the risk of injury to salivary structures and improving cosmesis. Case series have demonstrated its feasibility in pan facial fractures, although it is less commonly practiced [11].

Retrograde intubation

Retrograde intubation is a useful airway management technique in panfacial fractures where oral and nasal routes are contraindicated due to trauma, bleeding, or the need to maintain occlusion. It involves passing a guide wire through the cricothyroid membrane into the trachea and retrieving it through the mouth or nose

to guide endotracheal tube placement. Performed under local anesthesia, it offers a minimally invasive alternative to tracheostomy in cases of limited mouth opening. However, it is time-consuming and may cause complications such as bleeding, subcutaneous emphysema, or tracheal injury.[6]

Tracheostomy

Historically the "gold standard," tracheostomy provides secure long-term airway access and is useful in patients requiring prolonged ventilation [12]. However, it carries early risks (haemorrhage, infection, pneumothorax) and late complications (tracheal stenosis, fistula, unsightly scar). Reported complication rates range between 8–25% [13].

Despite these drawbacks, tracheostomy remains indispensable in cases with:

- Severe neurological injury requiring prolonged airway protection
- Extensive midface trauma with airway collapse
- Anticipated multi-stage surgical procedures

Fibreoptic Intubation

Fibreoptic bronchoscopy allows atraumatic intubation in cases with distorted anatomy, cervical spine immobilization, or limited mouth opening. It is particularly useful when general anaesthesia induction is unsafe without a secured airway [14]. However, availability of equipment and expertise limits widespread use in emergency trauma settings.

Cricothyroidotomy

In "cannot intubate, cannot ventilate" scenarios, surgical cricothyroidotomy is a lifesaving intervention. While not intended for definitive airway in pan facial fractures, it remains a vital component of trauma airway algorithms [15].

Comparative Outcomes

Multiple studies comparing SEI and tracheostomy demonstrate that SEI achieves adequate surgical exposure with significantly lower morbidity [16,17]. In retrospective analyses, SEI success rates exceed 95%, with complications limited to minor infections or scarring. In contrast, tracheostomy complications include tracheal stenosis (up to 10%), prolonged hospital stay, and higher long-term morbidity [18,19].

Meta-analyses suggest that SEI is preferable in short-term airway management for pan facial fractures requiring intraoperative occlusal evaluation, while tracheostomy should be reserved for patients needing prolonged ventilation [20].

Complications and Management

- **Submental Intubation:** Minor wound infection, accidental extubation, orocutaneous fistula (rare). Managed with antibiotics, resuturing, or conversion to tracheostomy if needed.
- **Tracheostomy:** Haemorrhage, surgical emphysema, recurrent laryngeal nerve injury, late stenosis. Prevention includes meticulous surgical technique and proper postoperative care.
- **Fibreoptic Intubation:** Equipment failure, airway trauma, desaturation during prolonged attempts. Requires expert operators and backup surgical airway plan.

Algorithmic Approach

Based on literature synthesis, the following algorithm is proposed:

1. **Emergency Phase**
    - Orotracheal intubation with cervical spine precautions if feasible.
    - Cricothyroidotomy as rescue if airway is obstructed.
2. **Definitive Surgical Phase**
    - If skull base intact → nasotracheal intubation may be considered.
    - If skull base fracture or NOE complex involved → submental or submandibular intubation preferred.
    - If prolonged postoperative ventilation anticipated → tracheostomy indicated.
    - If anatomy distorted/anticipated difficulty → fibreoptic intubation or awake tracheostomy.

This tiered approach balances surgical access, airway safety, and patient morbidity.

Future Directions

Emerging trends include:

- **Ultrasound-guided submental intubation** to improve precision and reduce complications [21].
- **Hybrid techniques** combining fibreoptic guidance with surgical airway access.
- **Simulation-based training** to improve proficiency in rare but critical airway strategies.
- **Digital workflow integration** in trauma centres for rapid multidisciplinary decision-making.

Conclusion

Airway management in pan facial fractures remains one of the most demanding tasks in trauma care. While tracheostomy continues to play a role in prolonged airway protection, submental intubation has emerged as the strategy of choice for short-term intraoperative management, offering surgical access with minimal morbidity. Nasotracheal intubation is contraindicated in many pan facial scenarios, while fibreoptic intubation serves as a valuable adjunct where expertise and equipment are available. A rational, algorithmic approach based on injury pattern, anticipated ventilation needs, and institutional resources ensures safe and effective care.

References

1. Markowitz BL, Manson PN. Panfacial fractures: organization of treatment. J Craniofac Surg. 1999;10(3):213-221.
2. Wenig BL. Management of panfacial fractures. Otolaryngol Clin North Am. 1991;24(1):93-101.
3. Perry M, Morris C. ATLS and facial trauma: airway management dilemmas. Resuscitation. 2008;76(1):15-22.
4. Adamo AK. Intraoperative airway management with panfacial fractures: alternative approach. J Oral Maxillofac Surg. 1990;48(7):666-668.
5. Chandu A, Smith AC, Gebert R. Management of maxillofacial trauma in an Australian tertiary hospital. Aust Dent J. 2002;47(1):51-54.
6. Smith JE. Facial trauma and airway management. Anaesthesia. 2016;71(1):96-107.
7. Altemir FH. The submental route for endotracheal intubation: a new technique. J Maxillofac Surg. 1986;14(1):64-65.
8. Rodrigues WC, de Melo WM, de Almeida RS, et al. Submental intubation in panfacial fractures: a retrospective study. Anesth Prog. 2017;64(3):159-163.
9. Shetty PM, Yadav SK, Upadya M. Submental intubation in panfacial fractures: a prospective study. J Maxillofac Oral Surg. 2014;13(4):435-440.

10. Chandra S, Sharma A. Ultrasound-guided Seldinger technique-assisted submental intubation in panfacial trauma. Br J Anaesth. 2021;126(3):e103-e105.
11. Altemir FH, Montero SH. Submandibular approach for tracheal intubation in panfacial fractures. Br J Anaesth. 1988;61(4):482-483.
12. Bernard AC, Kenady DE. Conventional surgical tracheostomy: preferred method of airway management. J Oral Maxillofac Surg. 1999;57(3):310-315.
13. Goldenberg D, Golz A, Netzer A, Joachims HZ. Tracheotomy: changing indications and a review of 1130 cases. J Otolaryngol. 2002;31(4):211-215.
14. Ovassapian A. Fibreoptic endoscopy and the difficult airway. 2nd ed. New York: Raven Press; 1996.
15. Henderson JJ. Emergency cricothyroidotomy. Br J Anaesth. 1997;79(5):734-735.
16. Lima SM Jr, Asprino L, Moreira RW, de Moraes M. Submental intubation in maxillofacial trauma: retrospective analysis. Int J Oral Maxillofac Surg. 2011;40(10):1037-1041.
17. Williams KD, Tariq M, Acharekar MV, et al. Submental intubation in maxillofacial procedures: a more desired approach. J Craniofac Surg. 2019;30(2):e119-e123.
18. Wood DE, Mathisen DJ. Late complications of tracheotomy. Clin Chest Med. 1991;12(3):597-609.
19. Biglioli F, Mortini P, Goisis M, Bardazzi A, Boari N. Submental orotracheal intubation: an alternative to tracheotomy. Skull Base Surg. 1999;9(2):127-133.
20. Park KN, Karm MH. Submental/submandibular intubation: journey from past to future. Anesth Pain Med. 2020;15(2):111-118.
21. Chandra S, Sharma A, Kumar A. Use of Griggs forceps for submental intubation: a modification. Indian J Anaesth. 2020;64(2):176-178.