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# Submental intubation in traumatic maxillofacial surgery

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ABSTRACT

In the maxillofacial trauma associated with base of skull fracture, nasotracheal intubation is contraindicated. Surgical repair may require intermaxillary fixation which contraindicate orotracheal intubation. The submental intubation is an interesting alternative to tracheotomy.

This type of intubation was used in maxillofacial surgery operating unit in 17 patients with mandibular fracture who require an intermaxillary fixation associated with a skull base fracture that contraindicated nasotracheal intubation.

Most lesions were Lefort II fractures. The average time of achievement of intubation was 10 min (range: 7–15 min). The average duration of intubation was 25 h (range: 6–48 h). There were no intraoperative complications. Postoperatively, the only complication was an infection at the incision site in one patient.

The submental intubation requires some technical abilities. Furthermore, it is quick to perform and avoids tracheotomy in selected patients.



## 1. Introduction

Upper airway management and the need for a free operative field in maxillofacial trauma constitute a daily challenge for the anesthesiologist and the maxillofacial surgeon [1].

Different methods of access to the airways are described in the literature [2]. There is currently no consensus on the best way to manage the airways when orotracheal (OTI) or nasotracheal (NTI) intubation is contraindicated [3]. Orotracheal intubation does not allow maxillomandibular blockage that maxillofacial surgen use to restore the tooth articulation and allow consolidation of the mandibular fracture. Nasotracheal intubation is contraindicated when facial fractures touch the nasal pyramid or radiate to the base of the skull. In these cases, a tracheostomy is usually performed. This procedure carries a high risk of iatrogenic complications [4].

Sub-mental intubation (SMI), which is rarely used in maxillofacial surgery, is currently an alternative to tracheotomy [2,5].

We describe our experience regarding this technique in order to evaluate its contribution to maxillofacial trauma.

## 2. Methods

This was a retrospective study between April 2016 and June 2018 performed at the maxillofacial surgery block. Following the approval of the local Ethics Committee and after obtaining the patient consent, Patients who had a facial clash and for whom OTI and NTI were contraindicated or hindered the surgical procedure were eligible. Patients with primary tracheostomy or prolonged intubation were excluded. Patient with Body mass Index (BMI) > 35 kg/m$^2$ were also excluded.

### 2.1. Protocol of anesthesia and post operative monitrage

All the patients were monitored by electrocardioscope, non-invasive pressure (NIBP), and pulse oxygen saturation (SpO2).

After placement of a 20-Gauge vein needle, vascular filling at 10 ml/kg of 0.9% isotonic saline was initiated.

The protocol of general anesthesia was standardized for all patients. Induction was made by Propofol 3 mg/kg, fentanyl 3 μg/kg and Cisatracurium 0.15 mg/kg in slow intravenous injection. After 3 min ventilation with facial mask by pure oxygen, patients were intubated with an adapted tube. Maintenance of anesthesia was started with Isoflurane with a minimum alveolar concentration (MAC) at 1%, fentanyl 0.5 μg/kg (whenever there is a change in heart rate (HR) and systolic blood pressure (SBP) of more than 20% of

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baseline values, and Cisatracurium 0.02 mg/kg every 30 min.

Expiratory $CO_2$ pressure ($PETCO_2$) was monitored. Artificial ventilation was provided by a controlled volume mode with a tidal volume at 8 ml/kg. A respiratory rate was started at 12 cycles/min and adapted for each patient, in order to obtain a $PETCO_2$ between 30 and 35 mmHg. An insufflation/expiration ratio was fixed at ½, and an equimolar mixture of 50% air and 50% oxygen was administered.

Patients who were extubated in the operating room were transferred to the post-anesthetic care unit (PACU) for 2 h. All the patients were admitted for at least 24 h postoperatively in the department of maxillofacial surgery. Patients who needed prolonged intubation were transferred to intensive care unit where they were extubated later..

### 2.2. Surgical technique: the sub-mental intubation realisation (Fig. 1)

After the standard protocol anesthesia and orotracheal intubation with an armed tube, and before beginning the surgical treatment, maxillofacial surgeon performed a 2 cm skin incision in the medial region of the sub-mental area, 1 cm from the mandibular margin. Platysmal dissection and identification of the medial margin of the anterior belly of the digastric muscle were performed. Two Kocher's forceps were reduced medially in relation to the anterior digastric forelimbs, in order to avoid damage to the sub-mental artery, the Wharton's canal and the lingual nerves. During the dissection, the tunnel should be sufficient to pass the tube without any interference: the internal planes must be dissected so as to ensure the same size of the incision of the skin. The exit into the oral floor was done by avoiding the submandibular orifice and duct. Then, ventilation was discontinued and the tube joint was dissociated to introduce the proximal end and the deflated balloon witness through the tunnel using Kelly forceps. The tube was then attached by lacing. It is important to make sure that the tube has not been moved during its passage through the tunnel. This can be verified using auscultation and capnography. After surgery, the probe was removed through the skin when the extubation criteria were met and the incision was sutured by the surgeon, patient transferred to ICU where they were extubated later when standard criteria of extubation where met in the same way (through the skin incision).

## 3. Results

Seventeen patients were retained. All were male and the average age was 31 (18–44).

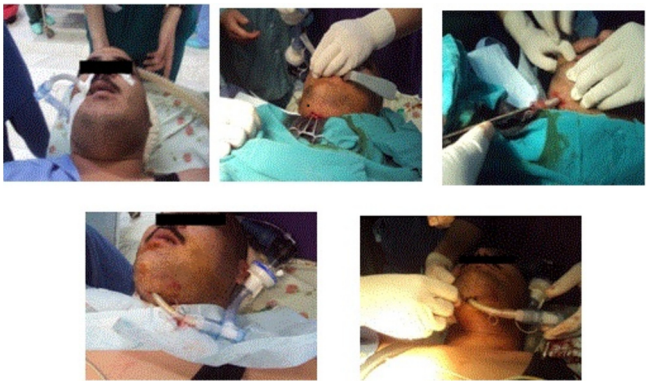

**Fig. 1.** Steps of submental intubation realisation.

Most maxillofacial trauma was a combination of fractures affecting the dental arch (Lefort I, mandibular fractures or alveolar fractures) and another dislocation fracture of either the base of the skull (Lefort type II or III fractures) or a centro-facial fracture (orbito-naso-ethmoid-frontal disjunction).

The surgical treatment allowed, for all the patients, not only the reduction and the osteosynthesis of the fractures but also the articular blocking.

The type of facial lesions is detailed in Table 1.

The average time to complete the SMI was 10 min (range: 7–15 min), with an average duration of 2 min of ventilator disconnection. No cases of desaturation or accidental extubation were noted. The average duration of intubation was 25 h (range: 6–48 h). Six patients were extubated in the operating room and 11 patients needed a postoperative prolanged intubation (For more than 24 h), so they were transferred to ICU where they were extubated.

No sensory or motor deficit was noted. The salivary duct was respected in all patients. There was noabnormal bleeding. The only complication we had was the infection at the incision site in one patient. After two months, the scar was almost not visible and well accepted by patients.

## 4. Discussion

Airway management for patients with panfacial fractures, requiring dental joint control, is a real challenge. NTI is contraindicated in maxillofacial trauma because of potential complications such as intracranial tube passage, meningitis, sinusitis, and sepsis [6,7].

Orotracheal intubation allows reduction and osteosynthesis of fractures but not joint blockage [8]. SMI combines the benefits of nasotracheal intubation with those of orotracheal intubation by allowing maxillomandibular blockage and access to the nasal pyramid [9,10]. It also avoids the risks of tracheostomy such as tracheal stenosis, pneumothorax, oeso-tracheal fistula and lesions of the vessels of the neck or thyroid gland [3,11]. Tracheostomy requires post-operative specialized nursing which is not available in hospitals in underdeveloped and developing countries.

The SMI was first described in 1986 by Hernandez Altemir [12] as an alternative to tracheostomy in maxillofacial trauma. Other indications such as nasal pathology or orthognathic surgery have been reported [4,6,10].

The contraindications to this technique are acute sub-mental infection, blood-sacrament disorders, modified laryngotracheeal anatomy, or the need for repeated operations or prolonged intubation. In such cases the tracheotomy is indicated [2,6,13,14].

The potential complications of the SMI are rare or even exceptional [2,9]: hypertrophic scar, accidental extubation, desaturation, haemorrhage, hematoma, submental infection and salivary fistula [2,6,13,15].

The original technique has been modified to make it safer regarding the vascular and respiratory systems [16].

Some authors prefer to perform a median approach as described by MacInnis [17] and this for two reasons: on the one hand, in this median region, only a few noble structures are present and therefore, there is less risk of vascular or nervous lesions. On the other hand, the median incision has a better healing and therefore a less cicatricial impact.

Referring to the authors' experiences and current literature, SMI is a safe technique, simple, low-demanding and low-morbidity procedure.

## 5. Conclusion

SMI is an alternative to tracheotomy for the airway management

**Table 1**
Types of facial lesions and per operative parameters.

| | Patient N° | Lefort I | Lefort II | Lefort III | ONEFD* | Mandibule | Rhinorrhea of CSF | Procedure Duration in each patient | Intubation Duration in each patient |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | | + | + | + | | 11min | 10 h |
| | 2 | | | | + | + | | 9min | 30 h |
| | 3 | | + | | + | | + | 8min | 10 h |
| | 4 | + | + | | + | | | 13min | 30 h |
| | 5 | | + | | | + | + | 10min | 8 h |
| | 6 | | + | | | + | | 10min | 8 h |
| | 7 | | + | | | + | | 8min | 6 h |
| | 8 | | | + | + | | + | 9min | 30 h |
| | 9 | | + | | + | | + | 8min | 30 h |
| | 10 | + | | + | + | | + | 12min | 15 h |
| | 11 | | | | + | + | | 7min | 10 h |
| | 12 | | | + | + | + | + | 8min | 48 h |
| | 13 | | | | + | | | 10min | 24 h |
| | 14 | | + | | + | | + | 10min | 30 h |
| | 15 | | + | | + | + | | 15min | 40 h |
| | 16 | | + | + | + | | | 10 min | 48 h |
| | 17 | | + | | + | + | + | 12min | 48 h |
| total | | 2 | 10 | 5 | 14 | 9 | 8 | 10min | 25 h |

* DONEf: orbito-naso-ethmoid-frontal disjunction.
ONEFD: orbito-naso-ethmoid-frontal disjunction.
* CSF: cerebrospinal fluid.

in panfacial fractures and dysmorphia with intubation difficulties.

It must be preferred whenever the indication is presented. SMI seems to be a reliable, simple and fast learning technique. However, it does require cooperation between anesthetist and trained maxillofacial surgeon.

Finally, SMI has a low incidence of per and postoperative complications and avoids the risks of tracheotomy and provides a better quality of care to patients.

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## Declaration of competing interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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