Intra-Operative Airway Management in Patients with Maxillofacial Trauma having Reduction and Immobilization of Facial Fractures

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ABSTRACT

Background: Despite advancements in airway management, treatment of fractures in the maxillofacial region under general anesthesia remains a unique anesthetic challenge. We reviewed the pattern of airway management in patients with maxillofacial fractures and assessed those challenges associated with the different airway management techniques employed. **Materials and Methods:** The anesthetic chart, theatre and maxillofacial operations records of patients who had reduction and immobilization of various maxillofacial fractures over a 2-year period were reviewed. Information obtained included the patient demographics, mechanisms of injury, types of fractures and details about airway management. Statistical Package for Social Sciences, SPSS version 17.0 was utilized for all data analysis. **Results:** Fifty-one patients were recruited during the 2-year study period. Mask ventilation was easy in 80–90% of the patients, 80% had Mallampati three or four, while 4 (7.8%) had laryngoscopy grading of 4. There was no statistically significant difference between the fracture groups in terms of the laryngoscopy grading (P = 0.153) but there was statistical significant difference in the technique of airway management (P = 0.0001). Nasal intubation following direct laryngoscopy was employed in 64.7% of the patients, fiber-optic guided nasal intubation was utilized in only 7.8%. None of the patients had tracheostomy either before or during operative management. **Conclusion:** Laryngoscopic grading and not adequacy of mouth opening predicted difficult intubation in this group of patients in the immediate preoperative period. Despite the distortions in the anatomy of the upper airway that may result from maxillofacial fractures, nasal intubation following direct laryngoscopy may be possible in many patients with maxillofacial fractures.

KEYWORDS: Airway management, maxillofacial trauma, reduction and immobilization

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INTRODUCTION

Treatment of fractures in the maxillofacial region, just like in other parts of the body, is by reduction and immobilization either under local or general anesthesia. However, treating fractures in the maxillofacial region under general anesthesia presents unique challenges.[1] The maxillofacial region being a shared field between the surgeon and the anesthetist is naturally a challenge for both specialists. In addition to this, when traumatic maxillofacial injury results in the disruption of the normal anatomy from edema or structural damage to tissues, bleeding, unstable skeletal structures, and foreign bodies that can interfere with instrumentation or easily get dislodged, a situation that requires sound and experienced anesthetic judgment is usually presented. These injuries could present in various ways and patterns, each with its own unique anesthetic challenges, requiring different modes of airway management based on their merit.

Hence, we reviewed airway management techniques in 51 patients with varied forms of maxillofacial fractures who had reduction and immobilization under general anesthesia over a 2-year period to determine the pattern of airway management employed in our center and challenges associated with each technique.

MATERIALS AND METHODS

The anesthetic chart, theater and maxillofacial operations records of patients who had reduction and immobilization of various maxillofacial fractures at the University College Hospital, Ibadan from December 2009 to November 2011 were reviewed. Data of patients with facial fractures were extracted and used for analysis. Information obtained included the patient demographics, mechanisms of injury, types of fractures, and details about airway management. All patients had standard general anesthesia. All

variables were expressed as the number of cases/percentages or means with standard deviations. Statistical Package for Social Sciences (SPSS) version 17.0, Chicago IL. was utilized for all data analysis. Statistical significance was defined as a $P < 0.05$.

Results

A total of 51 patients had reduction and immobilization of facial fractures under general anesthesia during the 2-year period. Age range was 4-58 years with a mean of 29.35 (±12.07) years. Majority of the patients were in the age group of 20-29 years (21 patients, 41.2%) with only seven patients (13.7%) above 40 years [Table 1]. Furthermore, 43 (84.3%) and 8 (15.7%) were males and females, respectively. Motor vehicular and motor cycle crashes were responsible for maxillofacial fractures in 39 (76.5%) and 8 (15.7%) of patients, respectively [Table 1].

The most common type of maxillofacial fracture requiring treatment under general anesthesia was mandibular fracture (16 patients, 31.4%), followed by panfacial fracture (15 patients, 29.4%), with the least being nasal complex fracture (three patients, 5.9%) [Table 1]. Mallampati grading were as follows; 5 (9.8%) patients each had grade 1 and 2, 16 (31.4%) had grade 3, and 25 (49.0%) had grade 4.

Mask ventilation was easy in 80-90% of patients in the different fracture groups. Furthermore, 43 (84.3%) of patients in this review had laryngoscopy grading 1 and 2. However, one patient each in the mandibular and zygomatic fracture groups (6.7%, 16.2%), and two patients in the maxillary fracture group (18.2%) had laryngoscopy grading of 4 [Table 2]. There was no statistically significant difference between the fracture groups in terms of the laryngoscopy grading ($P = 0.153$).

Nasal intubation following direct laryngoscopy and orotracheal intubation were employed in 33 (64.7%) and 14 (27.5%) of patients across the different fracture groups respectively [Table 3]. There was no statistical significant difference in the use of nasotracheal intubation in the different fracture groups ($P = 0.120$). Fiber-optic guided nasal intubation was utilized only in those patients with laryngoscopy grading of 4 that is, two patients with maxillary fracture, and one in the zygomatic and mandibular fracture groups, respectively ($P = 0.001$) [Figure 1]. There was statistical significant difference in the technique of airway management for the different fracture groups ($P = 0.0001$). No patient had tracheostomy either before or during operative management.

Table 1: Patient characteristics

	Number (%)
Age (years)	
<20	9 (17.6)
20–29	21 (41.2)
30–39	14 (27.5)
>40	7 (13.7)
Aetiology of trauma	
Motor vehicle accident	39 (76.5)
Motorcycle accident	8 (15.7)
Assault	2 (3.9)
Fall	1 (2.0)
Gunshot/blast injury	1 (2.0)
Fracture types	
Mandibular fracture	16 (31.4)
Panfacial fracture	15 (29.4)
Maxillary fracture	11 (21.6)
Zygomatic fracture	6 (11.8)
Nasal bone fracture	3 (5.9)

Discussion

Maxillofacial injury has been described in the medical literature as early as 2500 BC.[2] Road traffic injuries are becoming increasingly common in developing countries due to fast vehicular traffic on the highways and poor traffic management.[3,4]

It is of great importance to the society because young productive lives are often involved,[5,6] and there is a male predominance, our review and some others show this.[7,8] In this study, the male-to-female ratio is 5.3:1. This ratio is more than that reported in other countries (3:1 in England, France, and Jordan; 2.8:1 in the United States). The majority of patients in these studies were between 20 and 29 years of age, as was the case in our study.[9-11]

Maxillofacial fractures are commonly caused by road traffic crashes (RTC), assaults, sports, industrial accidents, and warfare. In this study, RTC involving cars and motorcycles were the most common cause of these fractures, comprising 92% of the etiology of the fractures. This figure was 40% in one study from the United States, 24.7% in one study from England, 48% in a study from France, and 55.2% in a study from Jordan.[9-11]

Difficult mask ventilation and difficult intubation are often seen following maxillofacial trauma. The trauma usually disrupts the facial anatomy with associated edema and bleeding in the oral cavity. It may be difficult for the mask to be properly close-fitted

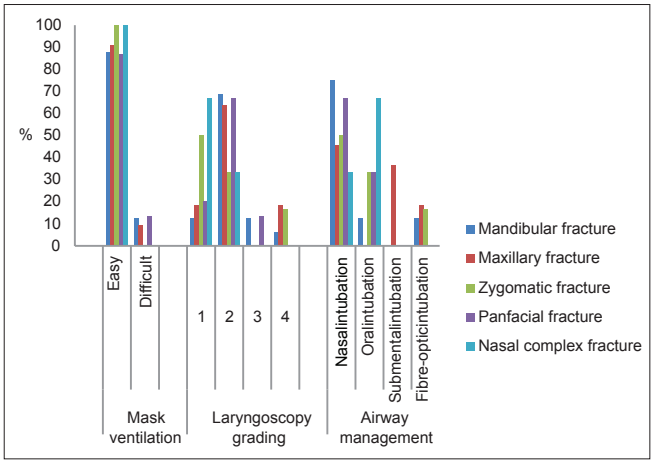

Figure 1: Types of fractures related to mask ventilation, laryngoscopy grading, and airway management techniques

Table 2: Laryngoscopy grading in the different fracture groups

Laryngoscopy grading	Type of fracture (*n*)					
	Mandibular	Maxillary	Zygomatic	Panfacial	Nasal bone	Total
1	2	2	3	3	2	12
2	11	7	2	10	1	31
3	2	0	0	2	0	4
4	1	2	1	0	0	4

Table 3: Laryngoscopic grading and airway management technique

Laryngoscopy grading	Airway management technique (*n*)		
	Nasotracheal	Orotracheal	Fiberoptic
1	7	5	0
2	22	9	0
3	4	0	0
4	0	0	4
Total	33	14	4

to the face, to enable effective mask ventilation as seen in some of our patients. In these patients, endotracheal tube was passed through one of the nostrils up to the nasopharynx, the patient's mouth and nostrils were closed with the fingers and thumbs of both hands, while another person manually ventilated the patient using a breathing system connected to the endotracheal tube. This technique, however, requires considerable experience. The challenge in performing endotracheal intubation arises mainly from the difficulty in visualizing the vocal cords with conventional direct laryngoscopy. This results mostly from displaced facial skeleton and pain which limits mouth opening. As observed in this review, 80% had Mallampati grading of 3 or 4, however, only 4 (7.8%) of them could not be intubated using direct laryngoscopy. This shows that pain is mainly responsible for the limited mouth opening seen in this group of patients and as such effective analgesia and muscle relaxation prior to laryngoscopy provided adequate mouth opening for intubation. From the foregoing, laryngoscopic grading and not adequacy of mouth opening predicted difficult intubation in this group of patients in the immediate preoperative period.

An adequate preoperative airway assessment and well thought out plan of action for airway management are mandatory before reduction and immobilization of facial fracture under anesthesia. This includes, but not limited to radiological investigations to reveal temporomandibular joint injury/comminuted facial fractures and other means of providing an emergency airway if the primary airway technique fails.

Although there are many options available for performing endotracheal intubation in patients with a facial fracture presenting for reduction and immobilization, a lot depends on patient's situation, expertise and facilities available.[12] A full range of difficult airway management tools is prerequisite to safe airway management in this group of patients. This includes, but not limited to; laryngeal mask airways, combitube, gum elastic bougie, video laryngoscopes, and tools for providing emergency surgical airway.

In our center, because of the additional cost of care and success often recorded with endotracheal intubation following a direct laryngoscopy in most of our patients, fiberoptic bronchoscopic assistance is usually reserved for those few cases of failed intubation. This is in contrast to the practice of routinely employing fiberoptic-assisted endotracheal intubation for patients with significant limited mouth opening. Proponents of the later claim there is a higher success with the use of fiberoptic bronchoscope if employed electively.[13]

The relative success we have with endotracheal intubation may not be unconnected to the early presentation of our patients after injury that is, before fracture healing. Furthermore, the presence of minimally displaced fractures in most of our patients [Figure 2] may be responsible for the success with direct nasotracheal intubation, as posteroinferior displacement of a fractured maxilla parallel to the inclined plane of the skull base often blocks the nasopharyngeal airway.[14]

In the absence of fiberoptic bronchoscope, blind nasal intubation is a common simple technique employed and often successful in the hands of experienced anesthetists. However, it has two major drawbacks: Infrequent success on the first pass and increased trauma with repeated attempts, precipitating complete airway obstruction that necessitates emergency cricothyrotomy.[15] The use of gum elastic bougie for patients with laryngoscopic grading 2 and 3 helped with endotracheal intubation and prevented the use of blind nasal intubation and/or fibreoptic guided intubation in about 70% of our patients. This supports the need to be equipped with the full range of airway management tools during anaesthetic care in this group of patient.

In an attempt to avoid both tracheostomy and nasotracheal intubation in patients with basilar skull fracture, orotracheal intubations can be used in some patients especially when the procedure precludes maxillomandibular fixation (MMF). In cases where MMF is required, the passage of an armored endotracheal tube through the floor of the mouth (submental) has been advocated [Figure 3].[16,17] Both anterior and lateral submandibular routes[18-20] have been described in the surgical management of severe panfacial or maxillary fractures. The technique, in its various forms, is said to be relatively simple and safe to perform and produces a cosmetically acceptable scar. It is further claimed that it may be safely used for elective ventilation for periods of

Figure 2: Nasotracheal intubation in a patient with multiple facial fractures

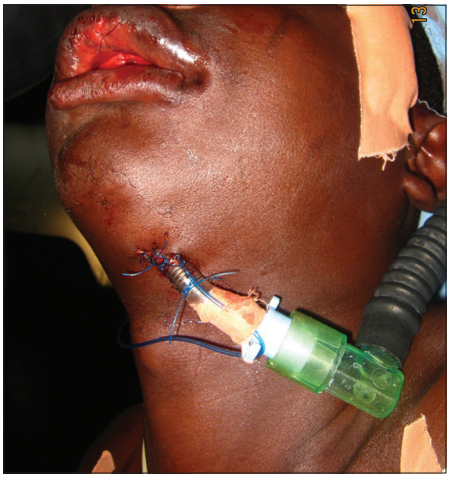

Figure 3: Orotracheal tube tunneled submentally

up to 10 days.[19] In a review, submental intubation was found to be safe, but increased tracheal pressure, as a result, of deviation and compression of tube was observed.[21]

In view of availability of video laryngoscopes, it is now uncommon to give surgical airway to patients with maxillofacial fracture coming for reduction and immobilization, except for patients with severe maxillofacial injuries or failed intubation.[22]

Despite the distortions in the anatomy of the upper airway that may result from maxillofacial fractures, nasal intubation with direct visualization of the vocal cords may still be possible in many of patients with maxillofacial fractures, especially when the injury spares the temporomandibular joint. However, some patients with maxillofacial fractures will require more advanced form of airway management like fiberoptic-guided intubation, especially those with displaced fractures. Though nasal intubation allows for surgical access and reduces the chances of dislodgement of the tracheal tube, the aim must be to employ the best method that effectively secures and maintains the airway. The presence of a skillful anesthetist and collaboration with maxillofacial and ENT surgeons are mandatory to ensure the best form of airway management and a successful outcome.

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