Vertically Unstable Fractured Mandibular Segment with Attached Genial Tubercles as a Parameter for Difficulty During Intubation for General Anaesthesia

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Abstract

Purpose It remains vital for the trauma management team including the anaesthetist and the operating surgeon to assess and evaluate the anticipated difficulty in intubation to secure airway and for administration of anaesthesia. This study assesses the difficulty in intubating patients with vertically unstable mandibular parasymphysis fracture with attached genial tubercles and associated musculature to the fractured segment.

Methods Randomized sampling was done from the cases with maxillofacial trauma planned for a surgical procedure under general anaesthesia. The inclusion criteria was to prospectively identify ten patients each of unilateral unfavourable mandibular parasymphysis fracture with genial tubercle attached to the displaced segment, with bilateral

unfavourable mandibular parasymphysis fracture with genial tubercle attached to the displaced segment and with unilateral favourable mandibular parasymphysis fracture with genial tubercle attached to the un-displaced segment. All the patients were intubated by a single anaesthetist, who documented the difficulty in nasoendotracheal intubation using Intubation Difficulty Scale.

Results Nasoendotracheal intubation was found relatively easy in the study group with unilateral favourable mandibular parasymphysis fracture with genial tubercle attached to the un-displaced segment. Clinical difficulty in intubating the patients was maximum in the study group with bilateral unfavourable mandibular parasymphysis fracture with genial tubercle attached to the displaced segment.

Conclusion Displacement of fractured mandible and resultant displacement of the genial musculature should be considered as a vital parameter for assessing difficulty during intubation.

Keywords Mandible · Fracture · General anaesthesia · Intubation · Maxillofacial · Intubation Difficulty Scale

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Introduction

A patient for maxillofacial surgery has peculiar requirements for general anaesthesia, as the airway—the oral and the nasal cavities—are shared by the surgeon and the anaesthetist, requiring a great collaboration and understanding each others needs during the procedure. In most instances nasotracheal intubation is the most suitable method of administering general anaesthesia for surgical procedures involving the oral cavity, as dental occlusion needs to be evaluated intra-operatively [1]. Difficulty in intubation is frequently

Fig. 1 Unilateral unfavourable mandibular parasymphysis fracture with genial tubercle attached to the displaced segment. (Arrow indicating the direction of displacement)

Fig. 2 Bilateral unfavourable mandibular parasymphysis fracture with genial tubercle attached to the displaced segment. (Arrow indicating the direction of displacement)

encountered in anaesthetic practice for maxillofacial surgery due to the aberrant anatomy or the pathological process in this region [2]. This study assesses the difficulty in intubation in patients with vertically unstable mandibular parasymphysis fracture with attached genial tubercles and associated musculature to the fractured segment.

Materials and Methods

Randomized sampling was done from the cases with maxillofacial trauma planned for a surgical procedure under general anaesthesia. The inclusion criteria was to prospectively identify ten patients each of unilateral unfavourable mandibular parasymphysis fracture with genial tubercle attached to the displaced segment (ten patients—Group A, Fig. 1), with bilateral unfavourable mandibular parasymphysis fracture with genial tubercle attached to the displaced segment (ten patients—Group B, Fig. 2) and Group C (ten patients) with unilateral favourable mandibular parasymphysis fracture with genial tubercle attached to the un-displaced segment (Fig. 3), as confirmed with imaging. The mean age of the patients was 33.2 ± 12.3 years, with a range of 20–60 years. All the 30 patients included had no systemic disease at the time of pre-anaesthetic evaluation (ASA Grade I). Group A, Group B and Group C patients were blinded for the anaesthetist involved in the study. All the patients were intubated by a single anaesthetist, who documented the difficulty in nasoendotracheal intubation using Intubation Difficulty Scale (IDS) as proposed by Adnet et al. [3]. Based on the IDS, criteria included for assessing the difficulty in intubation were number of supplementary attempts, number of supplementary operators involved, number of alternative techniques, glottic exposure as per Cormack grade, lifting force required

Fig. 3 Unilateral favourable mandibular parasymphysis fracture with genial tubercle attached to the un-displaced segment

during laryngoscopy, application of external laryngeal pressure and the position of the vocal cords. Mean with standard deviation for IDS score was calculated for each study group and inter-group comparison for assessing difficulty in intubation was done using analysis of variance (ANOVA).

Results

Nasoendotracheal intubation was found relatively easy in Group C patients. Majority of the patients in Group A and Group B were classified as Cormack Grades II and III whereas majority of the patients in Group C were Cormack Grade I and Grade II. IDS score for all the patients in three study groups is summarized in Fig. 4. Mean ($\pm$ SD) IDS

Fig. 4 Intubation difficulty scale score in three study groups

Table 1 Mean ($\pm$ SD) intubation difficulty scale score for the study groups

Study group	A	B	C
IDS score (mean $\pm$ SD)	3 ± 1.33 (Hi = 5; Low = 1)	3.5 ± 1.43 (Hi = 6; Low = 2)	2.1 ± 1.66 (Hi = 5; Low = 0)

score for Group A : 3 ± 1.33 , Group B: 3.5 ± 1.43 and Group C: 2.1 ± 1.66 (Table 1). The calculated probability of intergroup comparisons using ANOVA was 0.12. Although there was no statistically significant difference in IDS scores among the study groups, clinical difficulty in intubating the patient was maximum in Group B followed by Group A. IDS scores were minimum for Group C in this study. Degree of intubation difficulty in all the patients with mandibular fractures included in this study (except two in Group C and one in Group B) were classified as “slightly difficult” ($0 < \text{IDS} \leq 5$) as per IDS [3]. Degree of difficulty in intubation in two patients of Group C was classified under “easy” category ($\text{IDS} = 0$) and one patient in Group B was “moderate to major difficulty” ($\text{IDS} > 5$).

Discussion

Vertically unstable fractured mandibular segment with attached genial tubercles and its associated musculature has a tendency to displace in the inferior and backward direction. This displacement is a result of the resultant muscular pull on the fractured segment. Genial tubercles of the mandible give attachment to genioglossus and the geniohyoid muscles and in turn aid in supporting tongue and the hyoid bone in its anatomical position [4]. The break in the bony continuity of the mandible with loss of control at the genial tubercles, render genial musculature unstable. This muscular instability contributes to the loss of muscular support to the tongue and the hyoid. Under general anaesthesia even with the desired muscle relaxation, the downward and backward displacement of the genial

Table 2 Degree of difficulty as per intubation difficulty scale

IDS Score	Degree of difficulty
0	Easy
$0 < \text{IDS} \leq 5$	Slight difficulty
$\text{IDS} < 5$	Moderate to major difficulty
$\text{IDS} = \infty$	Impossible intubation

musculature poses difficulty in insertion of the nasoendotracheal tube. Genial tubercle and genial musculature were included as reference anatomical landmarks for this study, as suprahyoid musculature has substantial effect on displacement of the fractured mandibular segments, in turn affecting the anteroposterior airway dimensions. Suproinferior displacements at the fractured angle or ramal region may not have significant anteroposterior dimensional changes in the airway, although not investigated in this study.

Maxillofacial trauma poses a unique challenge for the anaesthetist, as the area of interest is shared by the anaesthetist and the operating surgeon. Moreover the management of airway is complicated with the presence of hemorrhage, tissue prolapse, or edema. It remains important for the trauma management team including the anaesthetist and the operating surgeon to assess and evaluate the anticipated difficulty in intubation to secure airway and for administration of anaesthesia [5]. Adnet et al. [3] have proposed a scale to evaluate the degree of difficulty during intubation, which was used to assess the difficulty in nasoendotracheal intubation by the anaesthetist in various mandibular fracture patterns in this study. The degree of difficulty encountered was graded as per the IDS, summarized in Table 2 [3].

All the patients with vertically unstable fractured mandibular segment (displaced) with attached genial tubercles demonstrated higher Cormack Grade for glottic exposure with increased lifting force required during laryngoscopy. Also, requirement for application of external laryngeal pressure for glottic visualization increased with the increased degree of downward and backward displacement of the genial musculature along with the displaced mandibular segment. Some parameters assessed in IDS may have subjective variability, to eliminate such errors all the patients were intubated by the same anaesthesiologist for this study.

Among the three study groups, intubation was found relatively easy in Group C patients with unilateral favourable mandibular parasymphysis fracture with genial tubercle attached to the undisplaced segment. Although ANOVA comparisons were statistically insignificant, IDS score was clinically maximum for Group B with bilateral unfavourable mandibular parasymphysis fracture with

genial tubercle attached to the displaced segment (3.5 ± 1.43).

Conclusion

Vertically unstable fractured mandibular segment with attached genial tubercles with genial musculature has an impact on the degree of difficulty during intubation for general anaesthesia in such patients. Displacement of fractured mandible and resultant displacement of the genial musculature should be considered as a vital parameter for assessing difficulty during intubation.

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