Aswan University Medical Journal, volume 5 / No.3/ September 2025 (212-218) Online ISSN: **2735-3117**

ORIGINAL ARTICLE

Video Laryngoscope for Nasal Intubation in Maxillofacial Trauma: A Comparative Study of Mandibular and Zygomatic Fractures

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ABSTRACT

Keyword: Maxillofacial Trauma, Video Laryngoscope, Mandibular Fracture, Zygomatic Fracture, Airway Management.

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Background: Maxillofacial trauma complicates airway management due to anatomical distortion and bleeding. Video laryngoscopy (VL) enhances visualization and improves intubation success rates. This study evaluates VL's effectiveness in nasotracheal intubation for mandibular and zygomatic fractures, focusing on success rates, intubation time, and complications. **Methods:** This prospective, randomized clinical trial was conducted at Aswan University Hospital .A total of 27 patients requiring nasal intubation due to maxillofacial trauma were included in this study. Patients were divided into two groups: Group A (14 patients) with mandibular fractures and Group B (13 patients) with zygomatic fractures. **Results:** Mandibular fracture patients had a significantly longer intubation duration. First-attempt success, Magill forceps use, cervical spine extension, and bleeding incidence showed no significant differences between groups. Complication rates were similar. **Conclusion:** patients with mandibular fractures may pose additional challenges due to airway misalignment and soft tissue obstruction, video laryngoscopy remains an effective tool to mitigate these difficulties. The comparable first-attempt success rates and low complication rates across both fracture groups reinforce its utility in trauma care.

INTRODUCTION

Maxillofacial trauma poses a significant challenge in airway management due to the distortion of normal anatomy, bleeding, and swelling. Effective airway control is crucial to prevent hypoxia and ensure patient stability, particularly in emergency settings. While direct laryngoscopy remains a common technique for intubation, it can be difficult in cases of facial fractures due to restricted mouth opening, airway obstruction, and poor visualization of the glottis. Recent advancements in airway management have led to the widespread adoption of video laryngoscopy, which has been shown to improve intubation success rates and reduce complications in patients with difficult airways **(1).**

Managing the airway during nasotracheal intubation (NTI) presents specific challenges in oral and maxillofacial surgery. The upper airway's complex structure, often impacted by facial abnormalities or trauma, requires careful and flexible intubation techniques. The nasal anatomy plays a vital role in both breathing and the sense of smell by filtering, humidifying, and detecting odors. Externally, the nasal vestibule, septum, bone, and cartilage are key to NTI, while internally, structures such as the turbinates (conchae), posterior nasal aperture, adenoids, Eustachian tube openings in the nasopharynx, and nasal

mucosa are significant. Video laryngoscopy (VL) provides a clear view of the nasopharynx and oropharynx—through which the nasotracheal tube passes—along with the laryngopharynx, including the epiglottis, arytenoids, and vocal cords **(8).**

The choice of intubation technique in patients with maxillofacial fractures is particularly important as these injuries can compromise airway patency and make conventional intubation methods challenging. Mandibular fractures can result in airway misalignment and soft tissue obstruction, whereas zygomatic fractures may contribute to swelling and bleeding that obscure the visual field during laryngoscopy. Studies have suggested that video laryngoscopy provides better glottic visualization, reduces cervical spine movement, and enhances first-attempt intubation success in trauma patients compared to direct laryngoscopy **(3).**. However, there remains a need for further comparative studies to determine its effectiveness in specific fracture patterns.

In addition to improving visualization, video laryngoscopy has been associated with a reduced need for external airway manipulation and adjunctive intubation techniques, such as the use of Magill forceps. Research has indicated that it minimizes the risk of esophageal intubation and facilitates a more controlled intubation process, which is particularly beneficial in maxillofacial trauma cases where securing the airway is time-sensitive **(2).**. Given these advantages, this study aims to assess and compare the effectiveness of video laryngoscope-assisted intubation in patients with mandibular and zygomatic fractures by evaluating parameters such as intubation time, first-attempt success rate, incidence of bleeding, and the necessity for additional airway management techniques.

SUBJECTS AND METHODS

This prospective, randomized clinical trial was conducted at Aswan University Hospital .A total of 27 patients requiring nasal intubation due to maxillofacial trauma were included in this study. Patients were divided into two groups: **Group A** (14 patients) with mandibular fractures and **Group B** (13 patients) with zygomatic fractures.

Preoperative assessments: included informed consent, detailed medical history, nasal examination, and airway assessment. Patients fasted for at least 8 hours before surgery without premedication. **Intraoperative Procedure**: standard monitoring was applied, and anesthesia was induced with fentanyl, propofol, and rocuronium, followed by face mask ventilation with oxygen and sevoflurane. Atropine was administered to reduce secretions, and oxymetazoline nasal spray was used for nasal preparation. A lubricated bougie was inserted through the nostril and guided past the nasopharynx, followed by placement of a reinforced, cuffed endotracheal tube (7.0 mm ID for men, 6.5 mm ID for women) using C-MAC® video laryngoscope, with Magill forceps IF needed. Certified anesthetists performed all intubations. and the following parameters were assessed: intubation time, first attempt success rate, bleeding, use of Magill forceps, and cervical spine extension.

Ethical Consideration:

The study was approved by the Ethical Committee of Aswan University Hospital (IEC Ref No: Asw. Uni./911/3/24) and registered on ClinicalTrials.gov (ID: NCT06386757). Written informed consent was obtained from all participants

Statistical examination

Data were entered into the computer and analyzed using version 20.0 of the IBM SPSS software program. (Armonk, New York: IBM Corporation) Quantitative and percentage descriptions were provided for qualitative data. The Kolmogorov-Smirnov evaluation was used to determine the distribution's normality. The range (minimum &maximum), mean, standard deviation, median and interquartile range (IQR) were used to describe quantitative data. At the 5% significance level, the derived results were deemed significant.

The used Evaluations were:

1 - **Chi-square test** for categorical variables, to compare among different groups

2 - **Student t-test** for normally distributed quantitative variables, to compare between two studied groups

RESULTS

In this study we included 27 patients, 14 patients with mandibular fractures, and 13 with zygomatic. The mean age in mandibular fracture and Zygomatic fracture group are 31.7 (12.3) and 32 (12.5) years respectively, while the BMI were 25.2 (3.6) and 23.6 (3.1) minutes, moreover, ASA I were 12 (85.7%) and 4 (30.8%), respectively.We found that the difference between mandibular fracture and Zygomatic fracture in inter-incisor Distance (cm) was not statistically significant p-value 0.17. While the thyromental Distance (cm) was significantly longer in mandibular group compared to zygomatic p-value = 0.04. Regarding Mallampati score, class I was 55% and 61% while class II was 50% and 38.5 % in mandibular fracture and Zygomatic fracture, respectively.Apart from thyromental distance there were no significant differences regarding demographic data **Table 1**.

Regarding the intubation duration, participants in mandibular fractures needed statistically significant longer intubation time compared to zygomatic group **Table 2 and Figure 1** . First trial success rate was not statistically significant between both groups. While the need for Magil forceps higher in the mandibular group but was not statistically significant compared to Zygomatic fracture p-value < 0.07 **Table 2 and Figure 2**, Moreover, the difference in the need for cervical spine extension between the two groups was statistically insignificant. Regarding the Occurrence of nasal and oropharyngeal bleeding, incidence of bleeding were statistically insignificant in both groups, moreover there were two cases found to be mild bleeding in the mandibular group. No moderated, severe or massive bleeding were reported in either group **Table 2**. The rate of complications were similar in both groups

Table 1: Comparison between the studied groups as regard patients data and preoperative parameters

		Mandibular n= 14	Zygomatic n= 13	p-value
Age (years)		31.7 (12.3)	32 (12.5)	0.9
BMI		25.2 (3.6)	23.6 (3.1)	0.2
Gender (male)		12 (85.7%)	10 (76.9%)	0.9

Smoking		11 (78.6%)	8 (61.5%)	0.58
ASA I		12 (85.7%)	4 (30.8%)	0.57
Inter-incisor Distance (cm)		4.6 (0.7)	5 (0.6)	0.17
Thyromental Distance (cm)		6.5 (0.6)	7 (0.6)	0.04 *
Mallampati score	1	7 (50.0%)	8 (61.5%)	0.82
	2	7 (50.0%)	5 (38.5%)	
Nasal Anatomy Abnormalities		2 (14.3%)	1 (7.7%)	1
Nasal Trauma History		13 (92.9%)	10 (76.9%)	0.53

Table 2: Comparison between the studied groups as regard Primary Outcome, Secondary Outcomes.

		Mandibular n= 14	**Zygomatic n= 13**	**p-value**
Intubation time (seconds)		55.8 (8.5)	47.9 (5.7)	0.009
Rate of first trial success		13 (92.9%)	13 (100.0%)	1
Number of 2nd trial success		1 (7.1%)	0 (0 %)	
Need for use of Magil forceps		9 (64.3%)	3 (23.1%)	0.07
Need for cervical spine extension		6 (42.9%)	3 (23.1%)	0.49
Need for fibro optic		0 (0 %)	0 (0 %)	1
Bleeding	No bleeding	5 (35.7%)	6 (46.2%)	0.35
	Minimal bleeding	7 (50.0%)	7 (53.8%)	
	Mild	2 (14.3%)	0 (0.0%)	
	Moderate	0 (0.0%)	0 (0.0%)	
	Severe	0 (0.0%)	0 (0.0%)	
	Massive	0 (0.0%)	0 (0.0%)	
Complications (lip or dental injury)		2 (14.3%)	3 (23.1%)	0.9
Desaturation		0 (0 %)	0 (0 %)	1

Figure 1: Comparison between the studied groups regarding mean intubation duration

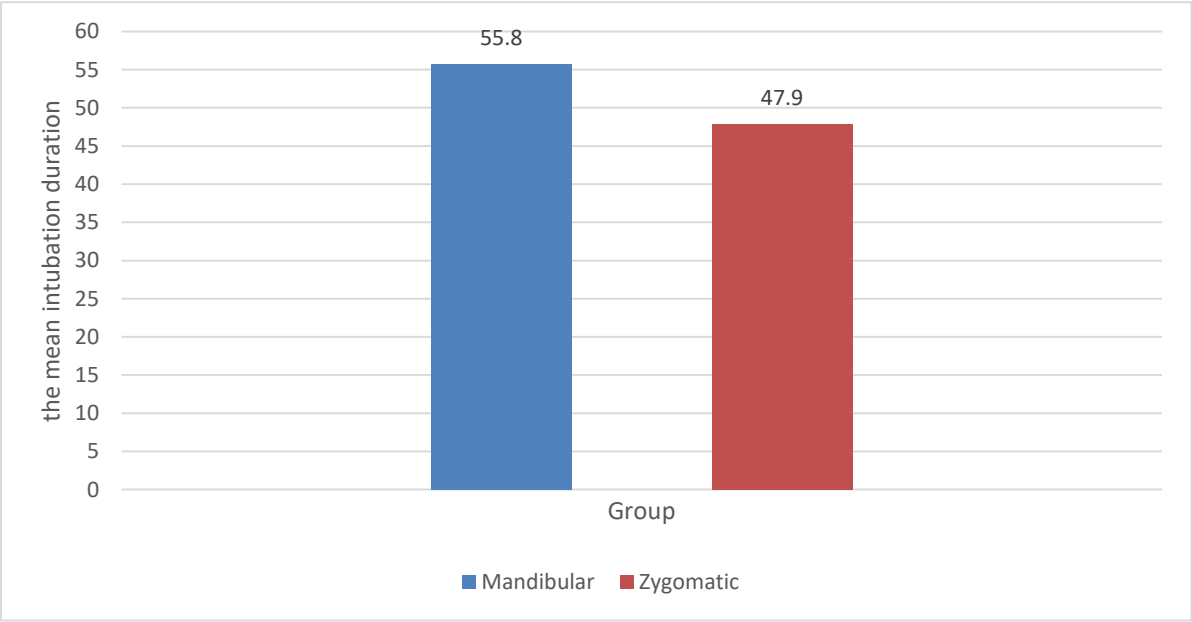
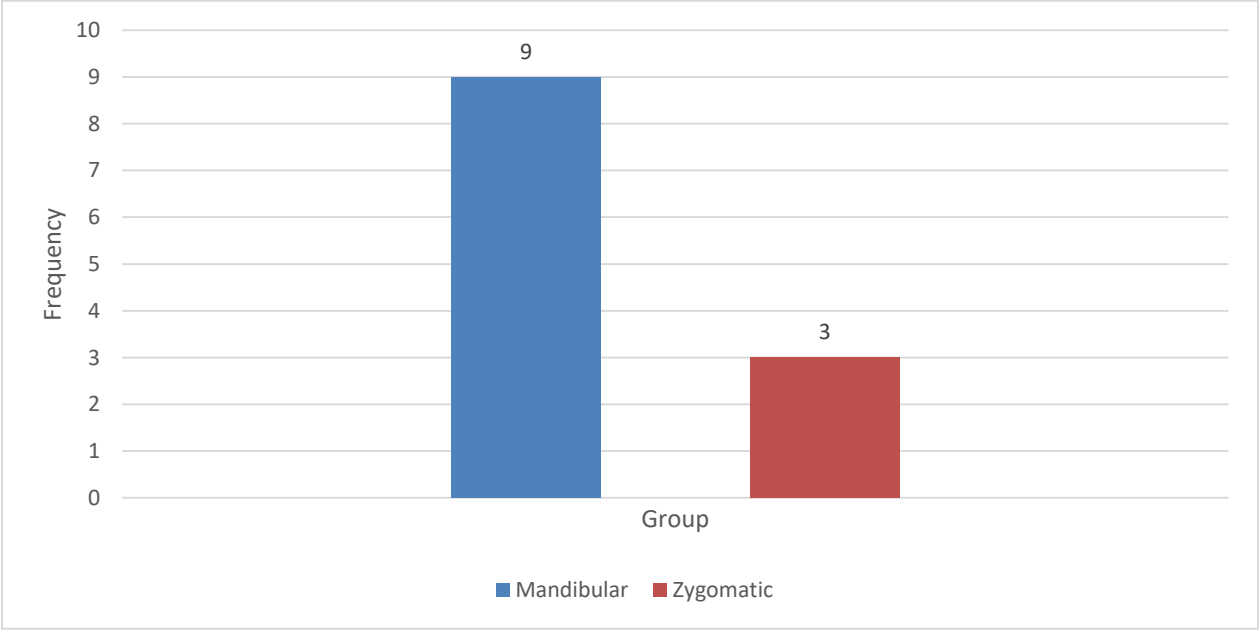


Figure 2: Comparison between the studied groups regarding frequency of Magill forceps usage



DISCUSSION

The findings of this study reinforce the advantages of video laryngoscopy in patients with maxillofacial trauma. Consistent with previous research, patients with mandibular fractures exhibited longer intubation times and required additional airway management maneuvers compared to those with zygomatic fractures **(10)**. This is likely due to the anatomical distortion caused by mandibular instability, which complicates direct passage of the endotracheal tube. However, video laryngoscopy facilitated better visualization and minimized cervical spine extension, making it a safer alternative to direct laryngoscopy**.**

First-attempt success rate is a critical measure of intubation efficiency, particularly in trauma patients where securing the airway rapidly is essential. In this study, first-attempt success rates were not statistically different between the two groups, indicating that video laryngoscopy provides a comparable level of effectiveness regardless of fracture type. However, the slightly lower success rate in mandibular fracture patients may be attributed to greater airway misalignment and soft tissue obstruction. Prior research suggests that patients with mandibular fractures often require multiple intubation attempts due to these factors, reinforcing the need for careful pre-intubation assessment and adjunctive airway management strategies **(7,9).**

Additionally, the incidence of nasal and oropharyngeal bleeding was similar in both groups, with no cases of moderate or severe bleeding reported. This finding suggests that video laryngoscopy may help mitigate bleeding-related complications by providing a clear airway view and reducing the need for excessive manipulation. However some studies report increased incidence of bleeding in mandibular fractures **(6,9).**

The requirement for Magill forceps was observed to be higher in cases of mandibular fractures compared to zygomatic fractures, although this difference did not reach statistical significance (p-value < 0.07). The increased reliance on Magill forceps in these cases suggests that airway management in mandibular fractures often presents greater challenges, necessitating the use of additional instruments to facilitate successful intubation. This finding aligns with previous research, which has reported similar trends and underscores the importance of utilizing adjunctive airway techniques when dealing with complex trauma cases. The need for specialized tools in such scenarios highlights the difficulties associated with airway access and emphasizes the critical role of appropriate airway management strategies in optimizing patient outcomes **(4).**

Another significant finding was the comparable need for cervical spine extension in both groups. Given that trauma patients may have concomitant cervical spine injuries, minimizing cervical movement during intubation is a priority. The ability of video laryngoscopy to facilitate successful intubation with minimal cervical spine extension has been well-documented **(5)**. This supports its role as the preferred technique in maxillofacial trauma cases

The overall rate of complications like dental fracture or lip injury was similar in both groups, further supporting the safety and effectiveness of video laryngoscopy in maxillofacial trauma patients. Future studies should explore larger patient cohorts and randomized controlled trials to confirm these findings and refine airway management protocols for trauma patients.

CONCLUSIONS

Video laryngoscopy represents a valuable advancement in airway management for patients with maxillofacial trauma. Its ability to improve glottic visualization, minimize cervical spine movement, and facilitate successful intubation makes it a preferred technique in emergency settings. While patients with mandibular fractures may pose additional challenges due to airway misalignment and soft tissue obstruction, video laryngoscopy remains an effective tool to mitigate these difficulties. The comparable first-attempt success rates and low complication rates across both fracture groups reinforce its utility in trauma care. Future research should focus on optimizing protocols for intubation in maxillofacial injuries to enhance patient safety and outcomes.

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