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Original Research Article

Optimizing airway management and anesthetic techniques in maxillofacial procedures

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ABSTRACT

Background: Airway management of maxillofacial trauma, such as road accidents, falls and violence, is challenging, especially when facial fractures or soft tissue injuries prevent conventional intubation. Preventions such as nasal and fibreoptic-guided intubation prevent complications to avoid tracheostomy. This study aimed to evaluate the efficacy of various airway management methods for improving patient outcomes after maxillofacial trauma.
Methods: This retrospective observational study was conducted at Bangabandhu Sheikh Mujib Medical University, Dhaka, from January 2017 to December 2019. A total of 150 patients who underwent maxillofacial surgery were included in this study. The etiology and types of trauma, airway management approaches (nasal intubation, oral intubation, fiberoptic guided intubation and tracheostomy) and anesthesia outcomes were identified. Descriptive statistics, t-tests and chi-square tests were performed for the statistical analysis.
Results: Of the 150 patients, 56% underwent nasal intubation, 19.3% underwent oral intubation and 24.7% underwent fiberoptic-guided intubation. Oral access was limited; however, nasal intubation was predominant and provided stable airway management. In 17.3% of the cases, fiberoptic-guided intubation with sedation provided a minimally invasive option with improved visualization. Importantly, none of the patients were tracheostomized, confirming the efficacy of nonsurgical techniques.
Conclusions: Safe and effective airway management techniques utilized in nasal and fiberoptic-guided intubation for maxillofacial trauma patients were shown to reduce the need for invasive procedures, such as tracheostomy. The use of these minimally invasive methods improves patient outcomes by improving airway control and decreasing complications in cases of complex trauma.

Keywords: Airway management, Anesthesia techniques, Intubation, Maxillofacial trauma, Tracheostomy

INTRODUCTION

Maxillofacial trauma is a major public health problem related to facial function and aesthetics. The etiology of these injuries is multifactorial, with road traffic accidents, falls, interpersonal violence and sports injuries being the leading causes. Especially noteworthy are cases where young adult males are at particular risk for injuring themselves in these high-risk behaviors.[1,2] RTAs are the first leading cause of maxillofacial injuries in various regions and it is imperative to have effective preventive measures as well as well-established trauma care system.[3,4] Maxillofacial trauma requires effective management to avoid significant long-term impairments since delays or inadequate treatment can occur. These may affect critical functions such as breathing, eating and speaking, all of which are important for Quality of Life.[5]

The risk mitigation for these risks necessitates that healthcare providers implement all-encompassing treatment strategies.

Airway management through conventional intubation routes is one of the most challenging aspects of managing maxillofacial trauma, especially when fractures or tissue swelling make it difficult for the airway to pass. Clinicians, however, often turn to nasal intubation when oral access is compromised.[6] In situations where both oral and nasal routes are not feasible, fiberoptic guided intubation has become superior. This method provides a safer navigation through the airway and a better visualization than traditional intubation, thus reducing the risk of further serious facial injuries during intubation.[7] Advancements in fiberoptic technology have significantly expanded the utility of this in maxillofacial trauma cases and places it in a critical role in the management of airways in complex situations.[8]

Tracheostomy is given as a last resort intervention in severe trauma cases, although the complication risk, infection, scarring and prolonged recovery time make this generally a second last resort. Recent studies suggest that non-surgical intubation techniques, particularly fibro optic guided techniques, are competent to manage the vast majority of maxillofacial trauma cases without requiring tracheostomy and therefore would minimize morbidity to the patient and improved recovery outcomes.[9,10]

This study aimed to assess the demographics, causative factors, types of injuries and airway management used in the management of patients with maxillofacial trauma. Specific emphasis will be placed on the efficacy of the various intubation strategies. By studying these methods systematically, this research seeks to contribute invaluable insights into how such methods can be improved to influence clinical protocols of the patients and ultimately, improve patient outcomes and minimize complications.

The objective of this study was to evaluate the effectiveness of various airway management and anesthetic techniques to optimize outcomes in patients undergoing maxillofacial procedures.

METHODS

This retrospective observational study was conducted at the Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from January 2017 to December 2019. A total of 150 patients who underwent maxillofacial surgery were included in this study.

Inclusion criteria

Diagnosis of maxillofacial trauma requiring surgical intervention.

Complete medical records were available during the study period. Consent for retrospective data collection.

Exclusion criteria

A history of severe comorbidities can increase the risk of surgical complications. Emergency tracheostomy is required prior to planned surgical intervention. Incomplete medical records

Data collection

Data were collected retrospectively from the patients' medical records, including demographic details, type and etiology of trauma, airway management techniques used (nasal intubation, oral intubation, fiberoptic intubation or tracheostomy), anesthetic techniques and outcomes. The collected data also recorded complications related to airway management and anesthesia.

Statistical analysis

SPSS software was used for the data analysis. Demographic data, trauma characteristics and the frequency of different airway management techniques were summarized using descriptive statistics. Differences between continuous variables were tested using t-tests and categorical variables were tested using the chi-square test. Statistical significance was defined as $p<0.05$.

RESULTS

Table 1 shows that, of the 150 patients, 129 (86%) were male and 21 (14%) were female. The greatest number (54%) of patients were young in the age group 21-30 years. Only 6.67% of patients are 41 or higher, 11.33% are 31–40 and 8.67% are 1–10.

Table 2 shows the etiology of trauma, in which a majority of 106 (70.67%) of the maxillofacial trauma was a road accident, which implies high-risk traffic behaviors or obstacles that lead to facial injuries. The second most common cause (14%) of sports injuries indicates that recreational activities are another source of trauma. Interpersonal violence, while minor, is present in 4.67% of assault-related injuries and 8.67% of falls. Other causes were responsible for a small proportion (2%) of the varied but infrequent sources of trauma.

The types of maxillofacial traumas are listed in table 3. Fracture of the mandible was the most common injury, occurring in 76 (50.67%) patients. The next most common were maxillary fractures (23.33 %) and zygomatic fractures (16 %), indicating that the injury site was the upper and lateral facial regions. Less common (6.67%) are pan facial fractures, multiple parts of the face and gunshot and blast are a minority (3.33 %), a smaller yet serious subset of trauma. Table 4 shows various intubation methods used for airways management in the maxillofacial surgeries during the anesthesia. The most

commonly used technique: nasal intubation 84 (56%) reflects its use in facial trauma cases in which access through the mouth is limited. In 29 (19.33%) of cases, when nasal intubation is contraindicated, oral intubation could be chosen. Fiberoptic guided nasal intubation with sedation is used in 26 (17.33%) of cases, a preference for fiberoptic techniques in cases with minimal disturbance to airway. Non-surgical airway management was effective (none required tracheostomy) and infrequently used, as this was performed 11 (7.33%) under fiberoptic guided intubation with general anesthesia.

Table 1: Demographic characteristics of the patient (n=150).

Parameters	Distribution	No. of patients	%
Age (in years)	1-10	13	8.67
	11-20	29	19.33
	21-30	81	54.00
	31-40	17	11.33
	≥41	10	6.67
Sex	Male	129	86
	Female	21	14

Table 2: Aetiology of trauma (n=150).

Aetiology of trauma	No. of patients	%
Road accidents	106	70.67
Sports injury	21	14.00
Fall	13	8.67
Assault	7	4.67
Others	3	2.00

Table 3: Type of maxillofacial trauma (n=150).

Types of maxilofacial trauma	No. of patients	%
Fracture mandible	76	50.67
Fracture maxilla	35	23.33
Fracture zygoma	24	16.00
Pan facial fracture	10	6.67
Gunshot and blast injury of face	5	3.33

Table 4: Various techniques of intubation used during anesthesia (n=150).

Various techniques of intubation used during anaesthesia	No. of patients	%
Nasal intubation	84	56.00
Oral intubation	29	19.33
Fibreoptic guided nasal intubation with GA	11	7.33
Fibreoptic guided nasal intubation with sedation	26	17.33
Tracheostomy	0	0

DISCUSSION

Anatomical and functional variations of the facial region create a problem in airway maintenance and anesthesia in cases with multi serial facial injuries. This work addressed the research questions by assessing patient characteristics, the type of trauma, kinds of injuries and techniques used in maxillofacial surgery in order to find the best practices for such cases. The largest group of maxillofacial trauma patients in this research were young adults, especially male patients, 21–30 years. This is also corroborated with the studies earlier and with this finding maxillofacial trauma is a most predominant group of accidents which involve young men owing to the risky behaviour in most of the RTAs.[11] 70.67% of the RTAs in the study were due to injury transport related, which are vehicular related. This further endorses this finding and findings that RTAs are the most common cause of maxillofacial injuries.[12] Likewise, frequent mechanisms of face injury other trauma cause such as sports-related injuries, injury due to falls and assault were described.[13] These results confirm the imperative to establish specific preventive measures and focus more on road traffic injury

prevention since such injuries tend to be frequent maxillofacial injuries linked to RTAs.

We found that mandibular fractures constituted the most common type of maxillofacial injury constituting 50.67%, maxilla at 23.33% and zygoma at 16%. This distribution is consistent with the tendency for fractures of the mandible, whereby the mandible is natural high, mobile and it's distribution.[3] The facial skeleton is also easily fractured in anterior forces and injury from RTAs often involved, leading to maxilla fractures.[2] In our study, pan-facial fractures make up 6.67% of cases and are challenging to both airway manage and repair surgically.[14] In spite of this, gunshot and blast injuries (3.33%) were infrequent but severe types of trauma that outweigh traditional approaches. The distribution of injury types concurs with prior findings of the common fracture sites in maxillofacial trauma, which identifies the mandible as the most common site of facial fracture.[15]

Airway management in maxillofacial trauma is a critical part of care considering that facial fractures can impede or complicate the airway. Nasal intubation was the modal technique used in 56% of cases, attesting to its efficacy and appropriateness as an alternate when oral access is unavailable. Previous research also demonstrates nasal intubation to be a feasible option in maxillofacial trauma maintaining a stable airway while avoiding interference with the surgical field in the oral cavity.[6] But if nasal intubation is contraindicated, 19.33% used oral intubation, but they need careful handling as it can lead to further trauma.

Fiberoptic guided intubation both with sedation (17.33%) and general anesthesia (7.33%) was found to be useful methods to provide intubation to those where traditional nasal or oral intubation was not possible. Fiberoptic-guided intubation with sedation has become more popular, so that it can be used sparingly for airway management in a minimally invasive manner thus reducing the risk for additional injury. It has been shown that fiberoptic techniques provide superior visualization and control and hence may be of particular value in maxillofacial trauma where airway structures may be obscured or compromised.[9] The findings highlight the need of fiberoptic equipment and appropriately trained personnel in a maxillofacial trauma setting to handle the complex ones.

The fact that no patients required tracheostomy in this study is important as it indicates that all intubations were non-surgical. A lack of tracheostomy suggests a trend to the least invasive techniques made possible by the progress in fibreoptic technology and skilled airway management.[10] Despite its critical role in difficult airways, in severe trauma such tracheostomy is a last resort option where other intubation techniques fail, its complications make it the least favored approach.

The high prevalence of these fractures suggests that clinicians must be skilled in managing trauma to these facial regions that often result in complex injury. Maxillofacial procedures employing nasal intubation therefore emphasize its reliability where oral access is limited, as it is the predominant intubation method. Advanced airway management tools and training are highlighted by the role of fiberoptic guided intubation in cases not formally suited to conventional methods. Maxillofacial trauma requires a structured, individualized approach to airway management with selection of the most appropriate technique based upon the specific injury profile and patient condition.

The practice of airway management in maxillofacial trauma is explored in this study and it is deduced that nasal intubation, fiberoptic intensive techniques and careful assessment of the patient are essential to successful airway management. Less invasive approaches in the management of complex maxillofacial trauma are demonstrated through the effective use of non-surgical airway methods in all cases. The use of such techniques will be crucial as the advances in airway manage continue and the fact that it can affect patient outcome and safety of patient in maxillofacial surgery.

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community. These findings should be validated in future research using multi center studies with larger sample. Clinicians managing complex maxillofacial trauma should train on fiberoptic intubation skills as part of programs that emphasize these skills. This will improve patient safety and outcomes. Furthermore, such high incidence of maxillofacial injuries could be reduced by preventive measures against traffic accidents.

CONCLUSION

Nasal and fiberoptic-guided intubation were effective and safe methods for managing airways in maxillofacial trauma, with no need for tracheostomy in any cases. Fiberoptic techniques, particularly, enhanced visualization, reduced complications and promoted recovery. These findings support minimally invasive techniques as preferable for airway management in complex trauma cases.

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