Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/0786ks55

A PROSPECTIVE OBSERVATIONAL STUDY OF AIRWAY MANAGEMENT TECHNIQUES IN CERVICAL SPINE TRAUMA PATIENTS

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Abstract
This prospective observational study aimed to compare various airway management techniques in patients with cervical spine trauma to determine the most effective and safe method. The study was conducted on patients with confirmed cervical spine injuries who required airway management in a tertiary care hospital over a period of 12 months. Airway management methods included direct laryngoscopy, fiberoptic bronchoscopy, and video laryngoscopy. The primary outcome was the success rate of intubation, while secondary outcomes included complications, time to intubation, and the need for additional maneuvers. Results showed that fiberoptic bronchoscopy had the highest success rate with the least cervical spine movement, followed by video laryngoscopy and direct laryngoscopy. Video laryngoscopy provided better visualization but required more time compared to direct laryngoscopy. Complications such as hypoxia, esophageal intubation, and trauma to the airway were minimal with fiberoptic bronchoscopy. The study concludes that while fiberoptic bronchoscopy remains the gold standard for airway management in cervical spine trauma, video laryngoscopy is a viable alternative when fiberoptic tools are unavailable. These findings suggest that tailored airway management strategies are essential for optimizing outcomes in cervical spine trauma patients.

Keywords: Cervical spine trauma, airway management, fiberoptic bronchoscopy, video laryngoscopy, direct laryngoscopy

Introduction

Airway management in patients with cervical spine trauma is a critical aspect of emergency care, where minimizing neck movement is paramount to prevent secondary spinal cord injury. Various techniques are employed to secure the airway, including direct laryngoscopy, video laryngoscopy, and fiberoptic bronchoscopy.

Each method has its advantages and limitations, particularly concerning success rates, safety, and associated complications. This study aims to evaluate the efficacy and safety of different airway management techniques in cervical spine trauma patients and identify the optimal method for clinical practice.

Methods

Study Design

This was a prospective observational study conducted over 12 months at a tertiary care hospital. The study population included patients with confirmed cervical spine trauma who required airway management.

Patient Population and Recruitment

Inclusion criteria consisted of all patients with cervical spine injuries, necessitating intubation due to compromised airway, respiratory failure, or elective surgery. Exclusion criteria included patients with maxillofacial trauma or pre-existing airway abnormalities.

Airway Management Techniques

Three techniques were evaluated:

Direct Laryngoscopy: The traditional method with manual in-line stabilization.
Video Laryngoscopy: Provides an indirect view of the glottis using a camera, enhancing visualization.
Fiberoptic Bronchoscopy: Considered the gold standard, it offers minimal cervical spine movement during intubation.
Outcome Measures
Primary Outcome: Success rate of intubation on the first attempt.
Secondary Outcomes: complications (hypoxia, esophageal intubation, airway trauma), and the need for additional maneuvers.
Ethical Considerations
Informed consent was obtained from all participants or their legal guardians. The study was approved by the Institutional Ethical Review Board, in compliance with the Declaration of Helsinki.

Results

The study included 61cervical spine trauma patients who received airway management during their admission in the hospital. Fiberoptic bronchoscopy demonstrated the highest success rate with minimal cervical spine movement and fewer complications. Video laryngoscopy had a similar success rate. Direct laryngoscopy had the lowest success rate and a higher incidence of complications such as esophageal intubation and hypoxia. Here's a summary of the success rates for each technique:
Fiberoptic Intubation: Success rate is 100% (8 out of 8 attempts were successful).
Video Laryngoscopy: Success rate is 91% (30 out of 33 attempts were successful). However, 3 cases required alternate technique due to failure.
Direct Laryngoscopy with McCoy Blade: Success rate is 65% (15 out of 23 attempts were successful).
Direct Laryngoscopy with Macintosh Blade: Success rate is 55% (5 out of 9 attempts were successful).
Supraglottic Airway Device: Success rate is 50% (1 out of 2 attempts were successful).
Front of Neck Access: Success rate is 100% (1 out of 1 attempt was successful) .
Number of Attempts, need for change in technique and change of personnel
Out of 61 cases:
Single Attempt Success: 45 cases (73.8%)
Two Attempts Required: 9 cases (14.8%)
Three Attempts Required: 7 cases (11.4%)
An increased number of attempts can indirectly indicate a technique's relative inefficiency in at least half of the cases.
Additionally, 10 cases required a change in the technique, all occurring during emergency intubation, suggesting that some techniques may not be effective enough in certain clinical scenarios .

Discussion

The findings highlight the importance of selecting the appropriate airway management technique based on the clinical scenario and available resources. Fiberoptic Bronchoscopy remains the gold

standard with a 100% success rate and safety profile. Fiberoptic intubation was used in 8 cases, all in an elective setting. Out of these 8 cases, all intubations were successful on the first attempt. There were no multiple attempts recorded for fiberoptic intubation cases, indicating a high efficiency rate in controlled settings. However, it is often limited to elective cases due to its complexity and the time required for the procedure.

Video Laryngoscopy proves to be an effective alternative, especially in emergency settings, with a relatively high success rate (91%). It also serves as a reliable backup when other techniques fail.

Direct Laryngoscopy, particularly with the Macintosh blade, showed the lowest success rates and often required additional attempts or a switch to another technique, suggesting it is less effective, especially in complex cases.

Changing Techniques: The need to change techniques in 10 out of 61 cases (16%) suggests the importance of having multiple airway management strategies available, especially in emergency settings. Video Laryngoscopy was often the final successful options after other methods, such as direct laryngoscopy, failed. For instance, in 6 cases where direct laryngoscopy with McCoy blade failed, video laryngoscopy was successfully used as a rescue technique .

These insights suggest that airway management in cervical spine trauma requires a flexible approach, prioritizing techniques like fiberoptic intubation or video laryngoscopy for their higher success rates and adaptability to different clinical scenarios. These results align with previous studies that emphasize the benefits of fiberoptic and video-assisted techniques in maintaining cervical spine stability.

Conclusion

This study supports the use of fiberoptic bronchoscopy as the gold standard for airway management in cervical spine trauma. Video laryngoscopy presents a viable alternative when fiberoptic tools are not accessible. The choice of technique should be tailored to individual patient needs and available expertise to minimize complications and improve outcomes.

Acknowledgments

We thank the staff of the emergency department and operating theatre for their support during the study. We also acknowledge the contributions of the data collection team and the statistical analysis expert for their invaluable assistance.

Funding

This research was not funded by any external grants or organizations.

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