

ORIGINAL ARTICLE

Comparison of the stylet and the gum elastic bougie in tracheal intubation in a simulated difficult airway

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ABSTRACT

Objective: To compare the stylet and the gum elastic bougie in tracheal intubation of a simulated difficult airway.

Study design: Randomized control trial.

Place and time period: The study was conducted in Main Operation Theatre at Rehman Medical Institute, Peshawar from June 2009 to June 2010.

Method: 56 patients, ASA grades I and II, undergoing elective surgical procedures requiring tracheal intubation were randomly divided in two groups. Difficult intubation scenario was simulated by applying a rigid Philadelphia collar in both groups. Patients in Group-A were intubated with a stylet and patients in Group-B were intubated using a gum elastic bougie. Both groups were then compared in terms of overall success in intubation, and number of intubation attempts. Statistical analysis was done by applying Chi-Square test and Students' T- test.

Results: Among the patients of Group-A, only 71.4% patients were successfully intubated using a stylet while 100% patients in Group-B were successfully intubated using a bougie.

Conclusion: In the simulated difficult airway, tracheal intubation using a gum-elastic bougie has a higher success rate when compared to stylet assisted intubation and should be preferred in a difficult intubation scenario.

Key words: Simulated difficult intubation; Stylet; Gum elastic bougie

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INTRODUCTION

Successful and quick tracheal intubation is a key to securing the airway and delivery of anesthesia; particularly in the management of difficult airway patients where speed and success is critical. Problems with tracheal intubation are a common cause of anesthetic morbidity and mortality. The Difficult Airway Society has developed guidelines for management of difficult intubation but they can only be implemented when all necessary equipment and appropriate training is available. According to the Advanced Trauma Life Support protocol, possible cervical spine injury requires the use of a rigid cervical collar to immobilize the neck in the neutral position.¹ However, direct laryngoscopy is difficult when the cervical spine is immobilized.² Multiple intubating aids or techniques e.g. nasal fiberoptic intubation, fiberoptic bronchoscopes, styletscope and airwayscope are recommended to facilitate

intubation in such patients.

Inconsistencies in training, lack of and subsequent unfamiliarity with these modern intubating aids demands that a modification in existing guidelines be made depending upon availability of resources from region to region. Due to the lack of resources and experienced personnel in the use of these instruments in most hospitals in Pakistan, these aids and therefore the necessary expertise in their optimum utilization, may not always be available in the management of the difficult airway. For training purposes a difficult intubation scenario can be simulated by applying a rigid cervical collar and making direct laryngoscopy difficult. The stylet and the gum elastic bougies are two devices designed to facilitate intubation under difficult circumstances. These are inexpensive and more readily available. The objective of this study was to compare the stylet or gum elastic bougie in intubation of a difficult simulated airway.

METHODOLOGY

This study was carried out in the Main operating theatre, Rehman Medical Institute, Peshawar. After approval from the hospital ethical committee and written informed consent, a total of 56 patients, planning to undergo elective surgery requiring tracheal intubation, were selected. Sample size was calculated to detect a difference of between two groups with 95% power and 5% significance level. Twenty eight subjects were required to be included in each group. Patients included in the study met the following inclusion criteria; American Society of Anesthesiologists (ASA) grade I & II patients scheduled to undergo elective surgery requiring tracheal intubation under general anesthesia, age group 18-45 years with Mallampatti class I and II as determined by preoperative anesthesia assessment done by a separate senior consultant. Patients that were excluded from the study group included those at risk of pulmonary aspiration e.g. obstetric patients and those at risk of regurgitation. Additionally, patients with cervical spine pathology, head and neck pathology and/or respiratory tract pathology that would make application of the rigid cervical collar difficult were also excluded.

Informed consent was obtained and patients were explained regarding the procedure. Patients were divided in Group-A and Group-B. Group-A was to be intubated using a stylet and Group-B was intubated using a bougie. The intubating aids were allocated randomly to either of the two groups. The method of randomization was based on consecutive sampling. After applying standard monitoring, anesthesia was induced in each patient with inj. propofol (2 mg/kg) and atracurium (0.5 mg/kg). Anesthesia was maintained with oxygen and sevoflurane. After allowing sufficient time for full relaxation, an appropriately sized, rigid cervical collar was positioned around the patients' neck. A stop

watch was then used for measuring intubation time. This was defined as the time from picking up the laryngoscope to confirmation of tracheal intubation by capnography. Tracheal intubation was considered a failure if it was not accomplished within three minutes or in three attempts. Any single forward movement of either device once introduced into the mouth was considered as an attempt. If intubation failed or hypoxia ($\text{SpO}_2 < 90\%$) occurred at any time during the attempt, the cervical collar was removed and the trachea was subsequently intubated under direct vision using a laryngoscope. Measurements were recorded on a proforma by another consultant who was not the intubating physician. Measurements recorded included number of intubation attempts and overall intubation success as yes or no (1, 2 or 3).

Data analysis: Data was analyzed with the help of SPSS version 11. Descriptive statistics were applied in the form of mean and standard deviation in both groups. The comparison of mean number of intubation attempts towards successful intubation was made among the two groups. Student's T test was applied for comparison of mean and Chi-square test was used to generate P-values for comparison of intubation success between the two groups. P value < 0.05 was considered significant.

RESULTS

Out of a total of 56 patients, only 71.4% of patients in Group-A were successfully intubated using a stylet whereas all patients in Group-B (100%) were successfully intubated using a bougie. Among those who were successfully intubated in Group-B, 78.5% patients were intubated in first attempt using a bougie compared to only 50% who were intubated in first attempt using a stylet in Group-A (Tables 1, 2).

Table 1: Success in intubation in the two study groups

	Group-A n=28	Group-B n=28	Total	P value
Success	20 (71.4%)	28 (100%)	48	
Failure	8 (28.5%)	0 (0%)	8	P=0.00225

Chi-Square = 9.33

P=0.00225 (<0.05)

Table 2: Number of intubation attempts in the successfully intubated patients in the two study groups

No. of Intubation attempts	Group-A	Group-B	Total	P value
1	10 (50%)	22 (78.5%)	32	P= 0.003
2	8 (40%)	4 (14.2%)	12	
3	2 (10%)	2 (7.1%)	4	
Total successfully intubated	20	28	n=48	

Chi-square=13.83

P=0.003(<0.05)

Comparison of the stylet and the gum elastic bougie

Both groups had similar patient profiles. The mean age in Group-A was 28.6 ± 4.25 years while in Group-B it was 26.2 ± 5.11 years. Gender distribution among the two groups was similar with male/female (M/F) ratio in Group-A as 16:12 and in Group-B 15:13. The difference in both groups was not statistically significant ($p=NS$).

All patients in Group-B were successfully intubated using a bougie (100%) compared to only 71.4% of patients in Group-A who were successfully intubated using a stylet ($p=0.00225$). The result was statistically significant ($p<0.05$).

Total number of patients successfully intubated with a single attempt was significantly greater in the bougie study Group-B (78.5%) as compared to Group-A (50%) ($p=0.003$). The analysis was limited to the 48 patients who were successfully intubated within 3 attempts.

DISCUSSION

Inability to intubate during anesthesia is considered a significant cause of anesthesia related deaths. The recommendation regarding trauma victims with "uncleared" cervical spines is tracheal intubation using manual in line stabilization (MILS).³ In such circumstances a cervical collar is usually left in place to restrict cervical spine movement to some degree.⁴ However, direct laryngoscopy is difficult in such patients due to limited neck extension and allows limited glottis view.⁵⁻⁷

Pre-operative evaluation of the airway can only pick between 15-50 % of patients who are actually difficult to intubate subjects.⁸

Contingency or back up plans are essential in difficult intubation circumstances to avoid substantial morbidity and mortality. These strategies may include a number of rescue devices or adjuncts that can facilitate successful placement of an endotracheal tube (ETT). In developing country scenario adjuncts prove to be advantageous only if they can be easily and quickly placed correctly in the trachea, should require minimal training and be readily available at low procurement and maintenance costs.

The gum elastic bougie is an inexpensive reusable elastic intubating aid used in cases where visualization of the glottis is difficult. The bougie may be inserted through the vocal cords and subsequently the endotracheal tube is railroaded over it.⁹ The stylet is a more rigid but malleable introducer which fits inside the endotracheal tube and allows for manipulation of the ETT shape; usually into a hockey stick shape, to facilitate passage of the tube through the laryngeal inlet.⁹ Both devices have proved to be useful in difficult intubation scenarios. Studies have shown that in patients with a poor laryngoscopic view, successful and quicker tracheal intubation was better achieved with a gum

elastic bougie rather than simply using an endotracheal tube with direct laryngoscopy in whom success rates were as low as 6.4%; all of whom were subsequently successfully intubated using a bougie.¹⁰ Other studies conducted on manikin models have preferred the bougie as first choice of intubating aid with a success rate of 96% compared to the stylet which had a success rate of only 66%.¹¹ These studies utilized manikins to provide a model for difficult intubation thus allowing for a more controlled environment to the intubating physician and therefore inevitably introducing bias in results. By providing a simulated model of limited glottic view by applying a rigid cervical collar on live human subjects presenting for elective surgery, instead of using manikins; our study attempted to more closely imitate a real life difficult intubation scenario in emergent conditions. The bougie is a very practical, lightweight and relatively inexpensive device that requires similar psychomotor skills to those previously attained by anesthetists trained in intubation with direct laryngoscopy.¹² Other effective adjuncts are numerous but familiarity with devices like video laryngoscopes and airway scopes is limited in Pakistan due to high cost of these devices and therefore their unavailability in most hospitals and the lack of substantial training and experience required for their optimal use.

The stylet in our study proved to be a less effective tool in securing the airway expeditiously. Additionally, the stylet has been implicated in previous studies as a concern in regards to injury caused by its rigid structure to soft tissues in the supraglottis, glottis and oral cavity which may cause substantial bleeding and edema of the glottis. Reports of complications associated with the use of stylets such as pharyngeal and palatal injuries have been reported, possibly occurring in part because the stylet mounted tracheal tube is inserted blindly.¹³ This can evidently turn a bad situation of "difficult to intubate" into "cannot intubate"; thus making the emergency worse. Similar problems were faced by our intubating physicians.

Kihara et al in their study compared an optical stylet with a conventional metal stylet in simulated difficult intubations and found higher success rates and lower rates of esophageal intubation using the optical stylet instead of the conventional rigid stylet.¹⁴ Reservations concerning its use in this regard have led to a decrease in the popularity and use of the stylet. The bougie being softer is less likely to cause tissue injury, providing for a relatively better laryngoscopic view. Our study provides evidence that the bougie may secure the airway more effectively in a single attempt more readily than a stylet before the need arises to utilize a supraglottic or other device that does not ultimately end with the placement of an endotracheal tube.

LIMITATIONS

Our study has some limitations; although our intubating physicians were senior anesthesia consultants we were unable to quantify their previous experience with either device. However, it was taken into account that the intubating physician had sufficient years of experience of >30 years and had encountered difficult intubations using both devices more than 100 times.

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Senior registrar, Department Manager of Anaesthesia and Intensive Care Unit Al-Zabrawi Surgical Hospital, Baghdad Medical City, Baghdad (Iraq)

Before few hours on my way from Baghdad to south of Iraq (Maysan) to my hospital, there I saw this accident at the roadside...saw one victim near the fired car then stopped my car and picked him with another man who was nearby. At that moment the gasoline tank explosion occurred and the body of truck protected us from the splinters...the patient was shocked due to popliteal and femoral bleeding, took a wire and applied as tourniquet on proximal thigh, on the way I did put him in the back of my car and continued talking to him to assess the consciousness level and assure him that I am a doctor and will never leave you, then reached the ambulance station after 10 minutes (drives 170 km/h) and there was just blue cannula, two IV lines with NS infusion and fixate the multiple fractures (femur+tibia+fibula) by woody sticks and bandaged. He also had # wrist and superficial trauma to forehead ...transported then to my hospital (center of trauma and ortho) by ambulance and saw him stable in ER and ready to be operated....thanks GOD and it is our job to save people anywhere even if the risks surround, we should help them anywhere and in all circumstances. So if this patient continued bleeding from these major vessels for 30 minutes when the ambulance called, then came, then picked him, then returned, took at least 30 minutes, could he survive? and he might have been dead from explosion of gasoline tank as he couldn't move himself....