



EFFECTIVENESS OF VARIOUS INTUBATION AIDS— BLOCKBUSTER LMA, VIDEO LARYNGOSCOPE, AND GUM ELASTIC BOUGIE IN ANTICIPATED DIFFICULT INTUBATION

Dr. Subarmanium Zacca¹, Dr. Baby Shanaz Geelani², Dr. Shaheena Parveen^{3*}

¹Postgraduate scholar, Department of Anesthesia Critical Care Pain and Palliative Medicine, Government Medical College Srinagar, Jammu and Kashmir, India.

²Associate Professor, Department of Anesthesia Critical Care Pain and Palliative Medicine, Government Medical College Srinagar, Jammu and Kashmir, India

^{3*}Professor, Department of Anesthesia Critical Care Pain and Palliative Medicine, Government Medical College Srinagar, Jammu and Kashmir, India.

Corresponding Author: Dr. Shaheena Parveen

Professor, Department of Anesthesia Critical Care Pain and Palliative Medicine, Government Medical College Srinagar, Jammu and Kashmir, India.

ABSTRACT

Background: Management of anticipated difficult airway remains a critical challenge in anesthesiology. Various intubation aids such as the gum elastic bougie (GEB), Blockbuster laryngeal mask airway (LMA), and video laryngoscope (VL) have been developed to improve intubation success and patient safety. **Objectives:** To compare the effectiveness of gum elastic bougie, Blockbuster LMA, and video laryngoscope in patients with anticipated difficult intubation. **Methods:** This prospective observational study included 145 patients with predictors of difficult airway. Patients were allocated into three groups: Group G (GEB, n=75), Group L (Blockbuster LMA, n=45), and Group V (VL, n=25). Baseline demographic parameters and airway assessment variables were recorded. The primary outcome was intubation success rate, while secondary outcomes included causes of failure. **Results:** Baseline characteristics including age, gender, BMI, Mallampati score, thyromental distance, inter-incisor distance, neck movement, and neck circumference were comparable across groups. The overall success rate was 88.27% (128/145). Group G demonstrated the highest success rate (100%), followed by Group L (91%), while Group V showed a significantly lower success rate (48%). Failures were attributed to malposition (n=8), failed passage to pharynx (n=5), and failed ventilation (n=4). **Conclusion:** Gum elastic bougie proved to be the most effective and reliable intubation aid in anticipated difficult airway, demonstrating superior success rates compared to Blockbuster LMA and video laryngoscope. Its simplicity, adaptability, and high first-pass success make it a valuable tool in airway management.

Keywords: Difficult Airway, Gum Elastic Bougie, Blockbuster LMA, Video Laryngoscope, Endotracheal Intubation, Airway Management, Mallampati Score, Intubation Success Rate.

INTRODUCTION

Endotracheal intubation is one of the most important skills in anesthesiology for securing the airway during general anesthesia and resuscitation. Failure to protect the airway can lead to serious morbidity and even death, which is why difficult intubation remains a major concern for anesthesiologists. The incidence of difficult intubation varies according to the clinical setting, patient population, and the skill of the intubator.

Prediction of a difficult airway is mainly based on clinical airway assessment, although multivariate models may perform better in testing than in urgent real-world situations. Common factors associated with reduced glottic visualization or difficult ventilation include anesthetist-related, equipment-related, patient-related, airway-related, and physical examination findings. [1-7]

Among the various airway adjuncts, the gum elastic bougie (GEB), also known as the Eschmann tube introducer, is a flexible semi-rigid device used to facilitate tracheal intubation when direct visualization is difficult. It was first introduced by Macintosh and colleagues and later popularized by Eschmann. The bougie is especially useful when only a partial glottic view is available, such as in Cormack-Lehane grade 2 or worse, or when the larynx is anteriorly placed. Its tactile feedback, ease of use, and ability to guide the endotracheal tube



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make it a valuable aid in anticipated difficult airway management. [8]

The laryngeal mask airway (LMA), introduced by Dr. Archie Brain in 1988, expanded airway management options by providing a supraglottic device for ventilation and, in selected designs, a conduit for tracheal intubation. The newer BlockBuster LMA, introduced in 2012, has gained attention for its anatomically curved tube, improved seal pressure, and its ability to serve as a blind intubation conduit. This makes it potentially useful in difficult airway situations where ventilation or intubation may otherwise be challenging. [9,10]

Video laryngoscopy has also transformed airway management by improving glottic visualization through indirect imaging. By placing a camera at the distal end of the blade and projecting the laryngeal view onto a monitor, video laryngoscopes can improve first-pass success and reduce the number of intubation attempts, especially in patients with anticipated difficult airways. They are particularly useful when neck movement should be minimized, when visualization is poor, or when mouth opening is restricted. [11-16]

A careful airway examination remains central to predicting difficulty. Mallampati classification, atlanto-occipital extension, thyromental distance, sternomental distance, mandibulothyroid distance, and inter-incisor distance are among the commonly used clinical predictors of difficult intubation. Reduced neck mobility, limited mouth opening, and short thyromental distance are particularly important warning signs. [17]

Although several tools are available for managing anticipated difficult intubation, direct comparative evidence between the BlockBuster LMA, video laryngoscope, and gum elastic bougie is limited. Therefore, the present study was undertaken to evaluate the effectiveness of these three intubation aids in anticipated difficult intubation and to identify the most reliable option for safe airway management.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective, observational, hospital-based study conducted in the Department of Anesthesiology and Critical Care, Government Medical College, Srinagar, over the study period after obtaining approval from the Institutional Ethics Committee.

Study Population: A total of 145 patients with anticipated difficult airway who fulfilled the inclusion criteria and provided informed consent were enrolled in the study.

Inclusion Criteria

Patients with predictors of difficult airway, including:

- Obesity (BMI > 24.9 kg/m²)
- Pregnancy
- Short neck
- Receding mandible
- Thyromental distance < 6.5 cm
- Tumors or polyps of larynx/pharynx
- Trauma to face or neck
- Cervical spine injury
- Restricted neck movement
- Mallampati Class III and IV
- Cormack-Lehane Grade III and IV

Exclusion Criteria

- Patients with normal airway parameters
- Mallampati Class I and II
- Cormack-Lehane Grade I and II
- Patients unwilling to participate

Preoperative Assessment

All patients underwent detailed airway evaluation, including:

- Mallampati classification
- Thyromental distance
- Inter-incisor distance
- Neck circumference
- Neck extension

All measurements were performed by a single observer using standard techniques to minimize inter-observer variability.

Grouping and Interventions

- Patients were allocated into three groups based on the intubation aid used:
- Group G (n=75): Intubation using Gum Elastic Bougie
- Group L (n=45): Intubation using Blockbuster LMA
- Group V (n=25): Intubation using Video Laryngoscope

Anaesthetic Technique

All patients received standard premedication with:

- Oral pantoprazole 40 mg
- Oral alprazolam 0.5 mg
- In the operating room, standard monitoring (ECG, non-invasive blood pressure, and pulse oximetry) was applied.
- Patients were preoxygenated with 100% oxygen for 3–5 minutes, followed by induction using:
- Glycopyrrolate 0.004 mg/kg
- Fentanyl 2 µg/kg
- Propofol 2 mg/kg
- Atracurium 0.5 mg/kg

Laryngoscopy and intubation were performed using the assigned device. Supplemental oxygen was administered via nasal prongs during apnea.

Outcome Measures

- Primary Outcome
- Success rate of intubation
- Secondary Outcomes
- Number of attempts required for successful intubation
- Causes of failed intubation (malposition, failed passage, failed ventilation)
- Airway trauma and complications

Statistical Analysis: Data were recorded in a predesigned proforma and entered into Microsoft Excel. Statistical analysis was performed using SPSS version 23.

- Categorical variables were expressed as frequency and percentage
- Continuous variables were expressed as mean ± standard deviation
- Chi-square test was used for categorical variables
- ANOVA test was used for comparison of continuous variables

- Pearson correlation was used to assess relationships between variables
- A p-value < 0.05 was considered statistically significant.

Ethical Considerations

The study was conducted after approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to inclusion in the study.

RESULTS

A total of 145 patients with anticipated difficult airway were included and allocated into three groups:

Group G (Gum Elastic Bougie, n=75), Group L (Blockbuster LMA, n=45), and Group V (Video Laryngoscope, n=25).

The mean age was comparable across the three groups, ranging from **42.5 to 44.4 years**. The overall study population showed a **slight male predominance**, though gender distribution remained balanced across groups. The mean BMI was uniformly elevated ($\approx 36 \text{ kg/m}^2$) in all groups, consistent with inclusion of patients at higher risk of difficult airway [Table 1].

Table 1: Demographic Profile (Age, Gender, Bmi)

Parameter	Group G (n=75)	Group L (n=45)	Group V (n=25)
Age (years, Mean ± SD)	42.5 ± 9.0	44.4 ± 8.8	43.44 ± 10.6
Male n (%)	40 (53.33%)	22 (48.88%)	14 (56%)
Female n (%)	35 (46.66%)	23 (51.11%)	11 (44%)
BMI (kg/m ² , Mean ± SD)	36.14 ± 4.2	36.4 ± 4.7	36.5 ± 4.17

A majority of patients belonged to **Mallampati Grade III (58%)**, with the remaining **42% classified as Grade IV**, confirming difficult airway characteristics across all groups [Table 2].

Table 2: Mallampati Score Distribution

Group	Grade III n (%)	Grade IV n (%)
Group G	41 (56.66%)	34 (45.33%)
Group L	28 (62.22%)	17 (37.77%)
Group V	15 (60%)	10 (40%)
Total	84 (58%)	61 (42%)

The most common thyromental distance was **6 cm (31.72%)**, followed by **5 cm (27.58%)**, indicating reduced mandibular space in a substantial proportion of patients [Table 3].

Table 3: Thyromental Distance Distribution

Distance	Total N (%)
5 cm	40 (27.58%)
5.5 cm	34 (23.44%)
6 cm	46 (31.72%)
6.5 cm	25 (17.24%)

The majority of patients had an inter-incisor distance of **3 cm (38%)**, suggesting restricted mouth opening in a significant number of cases [Table 4].

Table 4: Inter-incisor Distance Distribution

Distance	Total N (%)
2 cm	42 (28.96%)
3 cm	55 (38%)
4 cm	48 (33%)

Neck mobility was nearly equally distributed between **Grade III (51%)** and **Grade IV (49%)**, indicating limited cervical extension in most patients [Table 5].

Table 5: Neck Movement

Grade	Total N (%)
Grade III	74 (51%)
Grade IV	71 (49%)

Neck circumference was comparable across groups, with slightly higher values observed in **Group V**, further supporting the presence of predictors of difficult airway [Table 5].

Table 6: Neck Circumference (Mean ± SD)

Group	Mean (CM)	SD
Group G	56.9	8.2
Group L	57.2	8.4
Group V	60.4	7.5

DISCUSSION

Anticipated difficult airway remains one of the most important challenges in anesthetic practice, and the choice of intubation aid can directly influence the success and safety of airway management. In the present study, the three groups were broadly comparable in age, gender distribution, BMI, and airway assessment variables, which supports a valid comparison between the devices. Among the three intubation aids, the **gum elastic bougie (GEB)** demonstrated the best performance, with a **100% success rate**, compared with **Blockbuster LMA (91%)** and **video laryngoscope (48%)**.

The superior performance of the GEB in this study is consistent with prior literature. **Brimacombe J et al. (17)** reported that GEB-guided insertion of the ProSeal LMA achieved a 100% first-attempt success rate and was superior to digital and introducer tool techniques. Similarly, **Eschertzhuber S et al. (18)** found that guided insertion was more frequently successful at the first attempt in simulated difficult laryngoscopy with a rigid neck collar. **Maclean J et al. (19)** also observed that GEB-assisted placement improved positioning and reduced end-tidal carbon dioxide values, although insertion time was longer. These findings align well with the present study, where GEB emerged as the most reliable aid for difficult intubation.

The results also support the utility of GEB in difficult tracheal intubation settings beyond supraglottic device insertion. **Ohchi F et al. (20)** showed that GEB improved intubation performance in vomitus settings with direct and indirect laryngoscopes, while **Sut EY et al. (21)** reported the highest first-attempt success with GEB in simulated cervical trauma. More recent studies have reinforced

these findings. **Gupta S et al. (22)** reported 100% first-attempt success with GEB-guided PLMA insertion and less postoperative airway morbidity. **Kerai S et al. (23)** found better oesophageal patency and higher first-attempt success with GEB-guided LMA Protector insertion. Likewise, **Aleksandrowicz D et al. (24)** demonstrated that the standard gum elastic bougie was superior to the flexible tip bougie in first-attempt success, time to ventilation, and ease of use. Collectively, these studies support the present observation that GEB is a simple, effective, and dependable intubation aid in anticipated difficult airway.

The performance of **Blockbuster LMA** in the present study was intermediate, with a higher success rate than the video laryngoscope but lower than GEB. This is in keeping with previous studies on Blockbuster LMA as an intubating conduit. **Endigeri A et al. (25)** reported a higher first-attempt success rate with Blockbuster LMA than with Fastrach LMA, along with fewer complications and higher oropharyngeal seal pressure. **Solarajan S et al. (26)** found that Blockbuster LMA provided comparable ease of intubation and a high overall success rate, while **Modi K et al. (27)** concluded that Blockbuster LMA was a better conduit for blind oro-tracheal intubation than Fastrach LMA. **Yuvaraj V et al. (28)** also reported a higher first-pass success rate and shorter intubation time with Blockbuster intubating LMA. In the present study, however, although Blockbuster LMA performed reasonably well, it still did not match the consistency of GEB. This may reflect differences in operator familiarity, airway anatomy, and the mechanics of blind intubation through a supraglottic conduit.

Video laryngoscopy is widely recognized for improving glottic visualization, especially in anticipated difficult airway, obese patients, and situations where neck movement must be minimized. Its main advantage is better visualization of the larynx and real-time confirmation of tube placement. However, in the present study, it had the lowest success rate among the three devices. This suggests that improved visualization alone does not always translate into easier intubation, particularly when airway anatomy is unfavorable and mouth opening or tube negotiation remains difficult. Thus, while video laryngoscopy remains an important airway tool, its effectiveness may depend more strongly on technique, operator experience, and the specific airway challenge being encountered.

The airway profile of the present study population also supports the interpretation that these were truly anticipated difficult airway cases. Most patients had obesity, high Mallampati grades, reduced thyromental distance, reduced inter-incisor distance, and restricted neck movement. These are well-known predictors of difficult intubation and likely contributed to the lower success seen with devices that depend heavily on visual alignment or conduit passage. In this setting, the tactile advantage and tube-guiding ability of GEB appear to have offered the clearest benefit.

Overall, the present study suggests that among the three intubation aids evaluated, **GEB is the most effective and reliable option** in anticipated difficult intubation, followed by Blockbuster LMA, while video laryngoscope showed the lowest success in this cohort. The findings are consistent with the thesis literature and support the continued role of GEB as a dependable first-line or rescue adjunct in difficult airway management.

CONCLUSION

The present study demonstrates that the **gum elastic bougie (GEB)** is the most effective and reliable intubation aid in patients with anticipated difficult airway. It achieved a **100% success rate**, outperforming both the **Blockbuster LMA (91%)** and the **video laryngoscope (48%)**.

While the Blockbuster LMA proved to be a useful alternative with a reasonably high success rate, its performance was inferior to GEB. The video laryngoscope, despite offering improved glottic visualization, showed comparatively lower success, suggesting that visualization alone may not ensure successful intubation in difficult airway scenarios.

The superior performance of GEB can be attributed to its **simplicity, ease of use, tactile feedback, and adaptability to challenging airway anatomy**. Given these advantages, GEB should be considered a **first-line adjunct** in the management of anticipated difficult intubation, particularly in resource-limited settings.

Overall, this study reinforces the importance of selecting an appropriate intubation aid based on airway characteristics and highlights the continued relevance of GEB as a dependable tool in modern airway management.

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