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Original Research Article

COMPARATIVE EFFECTIVENESS OF CHANNELLED VERSUS NON-CHANNELLED BLADES OF THE BPL VIDEO-LARYNGOSCOPE FOR ORO-TRACHEAL INTUBATION: A RANDOMISED CONTROLLED STUDY

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ABSTRACT

Background: Video-laryngoscopy has revolutionized airway management by improving glottic visualization and intubation success rates. Blade designs vary between channeled and non-channeled types, with limited data comparing their effectiveness with the BPL video-laryngoscope.

Aim: To compare the effectiveness of channeled versus non-channeled blades of the BPL video-laryngoscope on glottic visualization and successful oro-tracheal intubation.

Materials and Methods: In this prospective randomized controlled study, 134 adult patients (Group CH = 67; Group NC = 67) undergoing elective surgeries under general anesthesia with endotracheal intubation were enrolled. Primary outcomes included time to optimal glottic view and time to successful intubation. Secondary outcomes were first attempt success rate, modified Cormack-Lehane grade, and complication rates.

Results: Mean laryngeal exposure time was significantly longer in the channeled blade group (6.03 ± 0.76 s) compared to non-channeled group (3.85 ± 0.68 s; $p < 0.001$). Time to successful intubation was comparable between groups (16.04 ± 1.09 s vs 15.85 ± 1.05 s; $p = 0.296$). Both groups had 100% first attempt success with no airway trauma observed.

Conclusion: Both channeled and non-channeled blades of BPL video-laryngoscope are effective and safe for oro-tracheal intubation. Non-channeled blades enable faster glottic visualization whereas overall intubation times are similar.

Keywords: Video-laryngoscope. Channeled blade. Oro-tracheal intubation.

INTRODUCTION

The management of the airway is a critical component in anesthesia and emergency medicine, with failure or difficulty in securing the airway being a major cause of morbidity and mortality. Direct laryngoscopy (DL) has traditionally been the gold standard for tracheal intubation, relying on the alignment of oral, pharyngeal, and laryngeal axes to obtain a direct line of sight of the glottis. However, DL requires significant manipulation, including head extension and neck flexion, which may not be feasible or safe in all patients due to risks such as cervical spine injury, hemodynamic disturbances, and trauma to soft tissues and teeth. These limitations have stimulated the evolution of airway devices, leading to the advent of video-laryngoscopes (VLs) which provide indirect visualization of the glottis via a camera and a video screen.[1,2]

Video-laryngoscopes have revolutionized airway management by improving glottic visualization without the need to align airway axes and by reducing the force required for intubation. This

results in less trauma and a potentially higher success rate, especially in patients with difficult airways. The technology has become widely accepted, with a steep learning curve making it accessible to clinicians of varying experience.[3]

VL devices are generally classified based on blade design into non-channeled and channeled types. Non-channeled blades are similar to standard Macintosh blades, allowing free control of the endotracheal tube but requiring skill to manipulate the tube during intubation, often necessitating a stylet which poses risks of airway injury during blind insertion phases. Channeled blades feature a dedicated tube-guiding channel, allowing faster and easier tube placement seen on the monitor, eliminating the need for a stylet but requiring more mouth opening and potentially complicating insertion due to blade bulkiness.[4]

Despite the efficacy of both blade types, there is a paucity of studies comparing disposable channeled versus non-channeled video-laryngoscope blades of the same manufacturer with comparable curvature and design. Understanding the comparative effectiveness of these blades is essential for optimizing intubation success rates, minimizing complications, and tailoring device selection to patient-specific airway challenges.[5]

Aim

To compare the effectiveness of channeled versus non-channeled blades of the BPL video-laryngoscope on glottic visualization and successful oro-tracheal intubation.

Objectives

- To compare the time from video-laryngoscope insertion to optimal glottic view between channeled and non-channeled blades.
- To compare the time from video-laryngoscope insertion to confirmed successful intubation between the two blade types.
- To assess the intubation success rate, number of insertion attempts, and complications associated with each blade type.

MATERIALS AND METHODS

Source of Data

Data were obtained from patients scheduled for elective surgeries requiring general anesthesia with endotracheal intubation at a tertiary healthcare center.

Study Design

This was a prospective, randomized, comparative, observer-blinded study.

Study Location

The study was conducted at a tertiary care hospital anesthesia department.

Study Duration

The study was carried out over a period of 18 months.

Sample Size

The total sample comprised 134 patients randomized equally into two groups: Group CH (channeled blade, n=67) and Group NC (non-channeled blade, n=67).

Inclusion Criteria

- Patients aged 18 to 60 years.
- American Society of Anesthesiologists (ASA) physical status I and II.
- Scheduled for elective surgery under general anesthesia requiring oro-tracheal intubation.
- Height ≥150 cm and weight ≥30 kg.

Exclusion Criteria

- Pregnant females.
- Body mass index (BMI) >30 kg/m².
- Patients undergoing emergency surgery.
- Anticipated difficult airway cases.
- Patients requiring rapid sequence induction.
- ASA classes III and IV.

Procedure and Methodology

Pre-anesthetic evaluation was done for all eligible patients, including routine investigations and airway assessment. Patients were randomly assigned to either Group CH or Group NC using a computer-generated randomization sequence.

On the day of surgery, after confirming fasting status and establishing standard monitoring (ECG, NIBP, SpO2), intravenous access was secured. Premedication with glycopyrrolate, midazolam, and fentanyl was administered. Patients were preoxygenated in supine position with the neck neutral. Anesthesia was induced with titrated propofol and muscle relaxation achieved with atracurium after confirming ventilation.

Video-laryngoscopy was performed by anesthesiologists with at least one year of video-laryngoscope experience. For Group CH, the channeled blade of the BPL video-laryngoscope was used, with the endotracheal tube preloaded into the channel. For Group NC, a non-channeled blade was used with a stylet-shaped endotracheal tube matching the blade curvature.

The blade was inserted using a midline approach without tongue sweeping, and laryngeal view graded according to the modified Cormack-Lehane grading. The number of attempts to achieve optimal glottic view and laryngeal exposure time (time from blade insertion to best glottis visualization) were recorded. Intubation time (from blade insertion to confirmation of tube placement by capnography) was recorded. In Group NC, the stylet was withdrawn upon passing the vocal cords. Attempts were limited to three; failure led to alternative airway management.

During the procedure, maneuvers such as head positioning and external laryngeal manipulation, use of bougie or stylet adjustments were noted. Post-intubation complications including airway trauma (evidenced by blood staining on the blade or tube), dental injury or desaturation episodes (SpO2 <95%) were recorded.

Sample Processing

The collected data included patient demographics, airway assessment scores, procedural times, attempts, and complications. These data were compiled electronically for statistical analysis.

Statistical Methods

Quantitative variables were expressed as mean ± standard deviation or median (IQR) and compared using independent t-tests. Categorical variables were expressed as numbers and percentages and compared using Chi-square or Fisher's exact test as appropriate.

Data entry was performed in Microsoft Excel, with statistical analysis carried out using IBM SPSS software version 25. A p-value <0.05 was considered statistically significant.

Data Collection

Data were collected prospectively during the perioperative period by trained observers not involved in the intubation procedure to maintain blinding. Data on intubation metrics, patient vitals, and adverse events were recorded systematically on case record forms.

RESULTS

Table 1: Comparison of Effectiveness of Channeled vs Non-Channeled Blades on Glottic Visualization and Successful Oro-Tracheal Intubation

Parameter	Group CH (n=67)	Group NC (n=67)	Test of Significance (95% CI)	P Value
Age (years), Mean (SD)	37.75 (12.11)	37.24 (12.21)	Mean difference 0.51 (-4.89 to 5.91)	0.81
ASA Physical Status I, n (%)	43 (64.18%)	45 (67.16%)	Chi-square, p = 0.716	0.716
Modified Cormack-Lehane Grade 1, n (%)	58 (86.57%)	52 (77.61%)	Fisher's exact, p = 0.26	0.26
Number of Laryngoscopy Attempts (1 attempt)	67 (100%)	67 (100%)	NA	NA
First Attempt Intubation Success Rate, n (%)	67 (100%)	67 (100%)	NA	NA
Oropharyngeal Trauma - None, n (%)	67 (100%)	67 (100%)	NA	NA

Table 1 presents a comparison of the demographic and clinical effectiveness parameters between the channeled blade group (Group CH) and the non-channeled blade group (Group NC), each consisting of 67 patients. The mean age of participants was comparable between the two groups, with Group CH having a mean age of 37.75 years (SD 12.11) and Group NC a mean age of 37.24 years (SD 12.21), showing no statistically significant difference (mean difference 0.51; 95% CI: -4.89 to 5.91; p = 0.81). The distribution of ASA physical status class I was similar as well, reported as 64.18% in Group CH and 67.16% in Group NC (p = 0.716). Regarding laryngeal visualization, the majority of patients in Group CH (86.57%) achieved a modified Cormack-Lehane grade 1 view, compared to 77.61% in Group NC, but this difference was not statistically significant (p = 0.26). All patients in both groups were successfully intubated on the first attempt, demonstrating 100% first attempt success rate with no recorded oropharyngeal trauma in either group.

Table 2: Comparison of Time from Video-Laryngoscope Insertion to Optimal Glottic View

Parameter	Group CH (n=67)	Group NC (n=67)	Test of Significance (95% CI)	P Value
Laryngeal Exposure Time (seconds), Mean (SD)	6.03 (0.76)	3.85 (0.68)	Mean difference 2.18 (1.87 to 2.49)	0.0001

Table 2 compares the time from video-laryngoscope insertion to optimal glottic view between the two groups. The mean laryngeal exposure time was significantly longer in Group CH at 6.03 seconds (SD 0.76), compared to 3.85 seconds (SD 0.68) in Group NC. The mean difference of 2.18 seconds was statistically significant (95% CI: 1.87 to 2.49; p = 0.0001), indicating that non-channeled blades provided faster glottic visualization.

Table 3: Comparison of Time from Video-Laryngoscope Insertion to Confirmed Successful Intubation

Parameter	Group CH (n=67)	Group NC (n=67)	Test of Significance (95% CI)	P Value
Time to Successful Intubation (seconds), Mean (SD)	16.04 (1.09)	15.85 (1.05)	Mean difference 0.19 (-0.18 to 0.56)	0.296

Table 3 compares the total time from video-laryngoscope insertion to confirmed successful intubation. The mean intubation time was 16.04 seconds (SD 1.09) in Group CH and 15.85 seconds (SD 1.05) in Group NC. The difference of 0.19 seconds was not statistically significant (95% CI: -0.18 to 0.56; p = 0.296), indicating comparable

overall intubation times between the two blade types.

DISCUSSION

The present study comparing the effectiveness of channeled versus non-channeled blades of the BPL video-laryngoscope demonstrates important findings that align with and expand upon existing literature. In Table 1, demographic and baseline airway parameters showed no significant differences in age or ASA physical status between groups, confirming comparability. Glottic visualization, assessed by modified Cormack-Lehane grade 1, was achieved in a high proportion in both groups (86.57% in channeled vs 77.61% in non-channeled, p = 0.26), consistent with previous studies indicating no significant difference in glottic exposure between channeled and non-channeled blades. Both groups achieved 100% success on the first intubation attempt without oropharyngeal trauma, reinforcing that both blade types are effective and safe in experienced hands. Shah A et al.(2019).[6]

Table 2 revealed a significantly longer laryngeal exposure time with the channeled blade (mean 6.03 s) compared to non-channeled blade (3.85 s, p = 0.0001). This finding is concordant with studies such as Lewis SR et al.(2016),[7] who reported delayed glottic visualization times with channeled blades, likely due to their bulkier design and need for precise positioning. Conversely, the channeled blade advantages lie in intubation ease once the glottis is visualized. Parasa M et al.(2016).[8]

Interestingly, Table 3 showed no significant difference in overall intubation time between the two groups (16.04 s vs 15.85 s, p = 0.296), which differs somewhat from findings reported by Biro P et al.(2018),[9] who observed shorter intubation times with channeled blades. Variations may be attributable to operator experience, device design differences, or patient factors. Nonetheless, the current study supports the conclusion that despite delayed visualization, channeled blades allow comparable intubation times due to facilitated tube delivery through the channel. Valencia JA et al.(2016).[10]

The 100% first attempt success rate in both groups mirrors observations from multiple randomized trials and meta-analyses highlighting video-laryngoscopy superiority over direct laryngoscopy for first attempt success and airway safety. The absence of airway trauma in this cohort aligns with growing evidence that video-laryngoscopes, both channeled and non-channeled, reduce mucosal injury compared to traditional laryngoscopy techniques. Cooper RM.(2015).[11]

CONCLUSION

This randomized controlled study comparing channeled and non-channeled blades of the BPL video-laryngoscope demonstrated that both blade types are effective and safe for oro-tracheal intubation in elective surgical patients. Non-channeled blades provided significantly faster laryngeal exposure times, whereas overall intubation times and first attempt success rates were comparable between groups. No airway trauma or complications were observed in either group. These results indicate that both blade designs are clinically reliable, and choice of blade can be tailored based on operator familiarity and specific clinical scenarios without compromising intubation success or safety.

Limitations

The study was conducted in a controlled elective surgical setting with patients having anticipated normal airways, which may limit generalizability to emergent or difficult airway scenarios. Operators were experienced anesthesiologists with prior familiarity in video-laryngoscopy, thus the findings may not be generalizable to novices or trainees. The sample size, although adequate for primary outcomes, was relatively small for detecting rare complications. Blinding was limited as operators could not be blinded to the blade type. Finally, the study focused on a single video-laryngoscope brand (BPL), limiting extrapolation to other device models with different blade shapes or features.

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