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KEY WORDS: Airway management, difficult airway, direct laryngoscopy, videolaryngoscope.

COMPARATIVE EVALUATION OF VL3 VIDEOLARYNGOSCOPY WITH DIRECT LARYNGOSCOPY FOR OROTRACHEAL INTUBATION IN ADULTS.

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ABSTRACT

Background- A varied plethora of videolaryngoscopes is now available in the Indian market. Various international guidelines including ASA guidelines recommend the use of videolaryngoscopy in difficult airway management. One of the recent additions to the videolaryngoscope family is the VL3 (Hugemed) videolaryngoscope. **Aim-** We aimed at comparing the effectiveness of VL3 videolaryngoscopy with direct laryngoscopy for routine orotracheal intubation in adults.Settings and design- This was randomized, prospective and single blind study consisting of 100 patients posted for elective surgeries under general anesthesia. **Methods-** A total of 100 patients were randomly divided into two groups of 50 each- group D- underwent direct laryngoscopy ; group V- underwent VL3 videolaryngoscopy. The following data was collected and analysed- first attempt intubation success, time of intubation , time to glottis visualization, Cormack Lehane (CL) grading, and any post laryngoscopy side effects. **Statistical analysis-** Students t test for continuous parametric data and Chi square test for categorical non parametric data. **Results-** TI was successfully carried out in all patients. Time to intubation was similar in both groups. In 4 out of 50 patients VL3 gave CL grade 2 and in 1 patient it was CL grade 3 where ELP and stylet was used. No significant post laryngoscopy side effects were seen with group V vs group D. **Conclusion-** VL3 videolaryngoscope was shown to provide a better visualisation and safe laryngoscopy in elective patients.

INTRODUCTION-

Endotracheal intubation is an integral part of anaesthetic practice. Following the discovery of Mac intosh and Millers laryngoscope in 1940s, direct laryngoscopy (DL) has become the "gold standard" in endotracheal intubation (1-3).However, DL has disadvantages like pressor response, incomplete visualisation, failed intubation and oropharyngolaryngeal morbidity.

A videolaryngoscope (VL) is produced by adding video and optical technologies to the direct laryngoscope. Numerous benefits of VL have been reported, and these include improved laryngeal view, visual confirmation of tube placement, high rates of successful rescue after failure of direct laryngoscopy (4), reduction in applied force (5), a steep learning curve (6), improved training of novices (7,8) and improved operator ergonomics (9).

Intubation with a videolaryngoscope is called indirect endotracheal intubation (10). A variety of studies have shown VLS to be superior to DL in facilitating TI especially in difficult airway situations (11,12,13). As a result, VL now finds its mention in various international guidelines for rescuing both anticipated and unanticipated difficult airway (14,15,16).

Since 2001, a variety of VLs have flooded the commercial market. The VL3 videolaryngoscope (Hugemed) is a newer addition to the growing VL family. It is lightweight ,hasreplaceable blade technology and has 3.5" display with 2 megapixel sensor and antifog lens. It has a blade angled at 66 degree and is available in neonatal, paediatric and adult sizes. (17)

While there are a plethora of studies evaluating the efficacy of different VLS like Kingsvision, Truview and C MAC. The data for Hugemed VL3 VL is comparatively scarce.

In this study our aim was to compare VL3 videolaryngoscopy with direct laryngoscopy for routine orotracheal intubation in adults in terms of time to visualisation, CL grade, first attempt intubation success and time to intubation.

MATERIALS AND METHODS-

This was a prospective, randomized, single blind study conducted in the department of anaesthesia between january 2023 and august 2023. This study was performed after obtaining approval of institutional ethical committee (L number-25/ 2023) and informed written consent from the patients. 100 American society of anaesthesiologist (ASA) grade I and II patients aged 20-65 years scheduled for elective surgeries under general anesthesia were selected for the purpose of this study.

The Following Inclusion Criteria Were Followed For Enrolment Of Patients In The Study-

1. Written informed consent from the patients.
2. ASA physical status I and II.
3. Patients aged 20-65 years of either sex.
4. Patients scheduled for elective general anesthesia.

Exclusion Criteria-

1. Patient refusal
2. Age < 20 years
3. ASA physical status III and IV.
4. Emergency tracheal intubations.

Using GPOWER software version 3.0.10 (Heinrich Heine University Dusseldorf, Germany), it was estimated that the least number of patients required in each group with effect size of 0.25, 80% power, and 5% significance level is 45. To cover any losses to follow up we took 50. Since we had to compare two groups in our study, we included 100 patients in our study.

The patients were randomly divided into two groups-
Group D- patients underwent direct laryngoscopy.

Group V- patients underwent VL3 (Hugemed) videolaryngoscopy.

Randomization was achieved by computer generated numbers. This was a single blind study where only the patients were unaware of the intervention.

All the study participants underwent a pre anaesthetic visit during which their basic demographic characteristics (age,sex, body mass index-BMI) were noted. Airway examination was done for all patients with respect to the following parameters-

- Mallampati scoring
- Interincisor distance
- Neck extension
- Thyromental distance (cm)
- El- Ganzouri Total Risk Index (EGRI)

The airway data allowed us to create two subgroups within each group- one with predicted difficult airway (EGRI>4) and ones without predicted difficult airway (EGRI<4).

The patients were kept fasting 8 hours prior to surgery and given tab alprazolam 0.25 mg night prior to surgery.

On the morning of surgery an 18G cannula was secured and patients were pre medicated with injection pantoprazole 40 mg iv . Upon being shifted to operation theatre (OT), all routine monitoring namely : heart rate (HR), non invasive blood pressure (NIBP) ,pulse oxymetry (SpO2) and electrocardiogram (ECG) was started.

General anesthesia was induced with propofol 3mg/kg, fentanyl 2mcg/kg and rocuronium 0.6mg/kg. Thereafter, tracheal intubation was done with either with Mac intosh laryngoscope or VL3 videolaryngoscope was done depending on the group allocated.

The Following Data Was Recorded As Primary Outcome-

1. Time to intubation(from the time of picking up of laryngoscope to confirmation of intubation by capnography)
2. Time to glottis visualisation
3. Cormack Lehane grade (CL)
4. First attempt intubation

Secondary outcomes- The above parameters were analysed in those with predicted difficult airway (EGRI>4).

Post laryngoscopy side effects (bleeding, post operative sore throat, dysphonia), if any, were noted.

Statistical Analysis-

The recorded data were compiled and entered in a spreadsheet (Micro Excel) and then exported to the data editor of SPSS Version 20.0 (SPAA Inc., Chicago, Illinois, USA). Continuous data were recorded as mean ± standard deviation. Categorical variables were summarized as frequencies and percentages. Student's independent *t*-test was employed for comparing continuous variables. Chi-square test was applied for comparing categorical variables. A $P < 0.05$ was considered statistically significant. All *P* values were two tailed.

RESULTS-

A total of 100 patients who were scheduled for elective general anesthesia were included in the study. Patients in both the groups were comparable with respect to all demographic characteristics - age, sex , weight and ASA status (Table 1).

Successful tracheal intubation was achieved in all patients. Time to intubation in VL3 group was 35±25.2 seconds which was significantly lesser than in direct laryngoscopy group which was 42±28.4 seconds. Time to glottis visualisation in group V (10±5.2 seconds) was significantly shorter than in group D (15±3.2sec). In group V, Cormack Lehane grading was grade 1 in 89.8% patients, grade 2 in 7.1% and grade 3 to 4 in 4.1% patients. In group D ,CL was grade1 in 85.5% patients, grade 2 in 8.2% and grade 3 to 4 in 7.3%. Thereby, showing better visualisation with VL3 videolaryngoscope. First attempt intubation (FAI) was achieved in 96% patients in group V whereas it was 85% in group D (Table 2).

Amongst those with predicted difficult airway time to intubation in VL3 group (36±22.4 sec) was significantly shorter than in group D (41±26.8 sec). More importantly , in difficult airway subgroup the time to visualisation was significantly shorter in group V (11±4.8 sec) than in group D (16±2.6 sec). First attempt intubation was achieved (FAI) in 85% patients in group V while FAI was achieved in 79% in group D(Table 3) .

Also, in difficult airway group VL3 showed better visualisation with 90.9% patients showing grade 1 as compared to 84.8% in direct laryngoscopy group (Table3).

A total of 8 patients had post operative sore throat. There was no other serious post laryngoscopy side effect seen in any patient.

Tables-

Table 1- Comparison Of Patient Characteristics Between Group Vl3 Videolaryngoscopy And Direct Laryngoscopy.

	GROUP V	GROUP D	P value
age	38.50±7.82	37.88±6.52	0.608
weight	65.30±5.50	66.05±6.85	0.562
sex(F/M)	24/26	26/24	0.762
ASA status n (%)			
ASA1	23(46)	24(48)	0.302
ASA 2	27(54)	26(52)	
EGRI>4 n(%)	12(24)	10(20)	0.425

The data are expressed as mean±SD and analyzed using unpaired t test or as n (%) and analyzed using chi square test. ASA- American society of anaesthesiologist; group V- VL3 videolaryngoscopy group ; group D- direct laryngoscopy group.

Table 2- Primary Outcomes

	Group V	Group D	P value
Time to intubation(sec)	38.5±25.2	42.8±28.4	<0.001*
Time to glottis visualisation (sec)	10.6±5.2	15.5±3.2	<0.001*
Cormack Lehane Grading(%)			
CL Grade 1	89.8	85.5	<0.001*
CL Grade 2	7.1	8.2	<0.001*
CL Grade 3 or 4	4.1	7.3	<0.001*
First attempt intubation(%)	96	85	<0.001*

The data are expressed as mean±SD and analyzed using unpaired t test or as n (%) and analyzed using chi square test. *- statistically significant. Group V- VL3 videolaryngoscopy group ; group D- direct laryngoscopy group.

Table 3- Secondary Outcomes

	Group V with EGRI>4	Group D with EGRI>4	P value
Time to intubation(sec)	36±22.4	41±26.8	<0.001*
Time to glottis visualisation (sec)	11±4.8	16±2.6	<0.001*
Cormack Lehane Grading(%)			
CL Grade 1	90.9	84.8	<0.001*
CL Grade 2	6.5	8.8	<0.001*
CL Grade 3 or 4	2.6	7.3	<0.001*
First attempt intubation(%)	85	79	<0.001*

The data are expressed as mean±SD and analyzed using unpaired t test or as n (%) and analyzed using chi square test. *- statistically significant. Group V- VL3 videolaryngoscopy group ; group D- direct laryngoscopy group.

DISCUSSION-

Endotracheal intubation remains a standard procedure in general anaesthetic practice. Since the beginning , direct laryngoscopy has been used for tracheal intubation. So much so , that direct laryngoscopy became synonymus with endotracheal intubation. However, it had the disadvantage of limited visualisation in difficult airway situations. This led to the need for alternative airway management devices one of which is videolaryngoscope. In time, videolaryngoscope has rapidly emerged as a highly effective device with many national and international guidelines recommending its use in difficult airway situations. However, limited access and lack

of adequate training limit the use of videolaryngoscopes in routine cases (18).

Since it's advent a variety of videolaryngoscopes have flooded the market. Amongst these, VL3 (Hugemed) videolaryngoscope is a relatively new soldier in the anesthesiologist's growing armamentarium. We decided to compare and evaluate the effectiveness of VL3 videolaryngoscope with direct laryngoscopy in routine general anesthesia cases.The study population was divided into two groups-Group V (VL3 videolaryngoscope) and group D (direct laryngoscopy). Both the groups were comparable in terms of age, sex and ASA status.

Various studies have shown videolaryngoscopes to shorten the time to intubation. Shin M et al (19) conducted a randomised , cross over , manikin study comparing Mc Grath MAC, C MAC and Macintosh laryngoscopes where they reported a significantly shorter time to intubation with videolaryngoscopes than with direct laryngoscope. L. Szarpak et al (20) also conducted a similar crossover manikin study comparing Mc Grath MAC and Mac intosh laryngoscopes for child intubation during resuscitation by paramedics. They reported Mc Grath MAC videolaryngoscope to provide faster intubation than Mac intosh laryngoscope. These workers studied videolaryngoscopes with patient in supine position. However, Bhat R et al (21) while comparing Mac intosh laryngoscope with C MAC videolaryngoscope in lateral position also reported faster intubation times with videolaryngoscope.

In our study, we compared the VL3 videolaryngoscope with Mac intosh laryngoscope.We found that time to intubation was significantly shorter with VL3 videolaryngoscope than direct laryngoscopy. Also, VL3 videolaryngoscope provided faster intubation time in patients with predicted difficult airway . Pascarella G et al (17) conducted a pilot study to investigate efficacy of VL3 videolaryngoscope in routine tracheal intubation in adults.They reported an intubation time of 46.6±21.2 sec ; which was similar to that seen in our study. The shorter time to intubation can be attributed to the superior glottis visualisation leading to lesser airway manipulation and airway trauma afforded by the videolaryngoscope which is highlighted in our study. Also the blade of VL3 videolaryngoscope is regular shaped similar to Mac Intosh videolaryngoscope which could also be a contributing factor, as reported by previous studies (19). Our study highlights the superiority of VL3 Videolaryngoscope in difficult airway cases which resonates with various international guidelines emphasising the use of videolaryngoscopes in difficult airway scenarios.

In our study, VL3 videolaryngoscope showed superior glottis visualisation than Mac intosh laryngoscope with majority of patients in group V showing Cormack Lehane Grade 1. More importantly, in patients with predicted difficult airway VL3 videolaryngoscope still offered a superior glottis visualisation than direct laryngoscopy. This result is similar to previous studies where different videolayngoscopes were studied and it was demonstrated that Cormack Lehane grade improves with use of a videolaryngoscope because the camera on the blade tip makes visualisation easier by eliminating the need to align oral-pharyngeal-laryngeal axis (19). Similarly the construct of VL3 videolaryngoscope incorporates a fibreoptic camera into the laryngoscope blade. This creates the advantage in visualisation of the target as the operator's eye is now located at the tip of the blade 2 to 3 cm proximal to the aditus ad laringem. The alignment of oral-pharyngeal-laryngeal axis, which is considered crucial in direct laryngoscopy,is thus rendered non essential in VL3 videolaryngoscopy(17). The number of attempts, and consequently the trauma to the airway, is also reduced (22).

Time to glottis visualisation was lesser with VL3 videolaryngoscope than with direct laryngoscopy. Also, the glottis visualisation time was shorter with VL3 videolaryngoscope in those with predicted difficult airway. Similar results were seen by Pascarella et al (17) who, while studying efficacy of VL3 videolaryngoscope , reported shorter glottis visualisation times in patients with predicted difficult airway. The faster glottis visualisation can be explained by easy visualisation afforded by the fibreoptic camera at the blade tip. This advantage has been seen with other videolaryngoscopes (19); and also seen in VL3 videolaryngoscope as highlighted in our study.

The success rate of first pass intubation was higher in VL3 videolaryngoscope group than with direct laryngoscopy group. The same was true for those with predicted difficult airway. Shin M et al (19) while comparing Mc Grath MAC, C MAC and Mac intosh laryngoscopes also reported findings similar to our study. However, Mc Elwain J et al (23) while comparing C MAC videolaryngoscope with Mac Intosh, Glidescope and Airtraq laryngoscopes in easy and difficult airway scenarios did not observe a significant improvement in success rate with C MAC over Mac Intosh. This could have been because the investigative anaesthesiologists in the study had over 17 years of experience with Mac intosh laryngoscope and limited experience with C MAC. This observation highlights an important finding in our study which is a high success rate provided by VL3 videolaryngoscope inspite of the investigative anaesthesiologists having limited experience with videolaryngoscope. This could be due to the lightweight construct making it easier to handle. Other contributory factors could be the regular shaped blade and close position of LCD screen to the blade which may allow better eye hand coordination resulting in better performance of tracheal intubation.

Limitations-

Our study has a few limitations-

1. This study was single blind ; the investigative anaesthesiologists could not be blinded, to which laryngoscope was being used, due to obvious reasons. To decrease this bias , the outcomes were defined before the start of the study and the patients were randomised into two groups using computer generated sequence.
2. We investigated the difficult airway situations based on El-Ganzouri Total Risk Index (EGRI). However, we did not investigate other difficult intubation conditions like cervical immobilisation, tongue oedema and pharyngeal obstruction . So our results cannot apply to these difficult airway scenarios.
3. Our study evaluates the use of VL3 videolaryngoscope in routine elective cases; however a study with wider spectrum is needed to comment on its use in airway emergencies and critical care settings.

CONCLUSION-

As compared to direct laryngoscopy VL3 videolaryngoscope serves as an effective airway device that not only facilitates tracheal intubation in routine airway cases but also in those with difficult airway.

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