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Direct Conventional Laryongoscopy versus Video Laryngoscopy

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Abstract

Objectives: To compare direct conventional laryngoscopy (DCL) and video laryngoscopy (VL) in patients with difficult airway and to assess whether video laryngoscopy is superior to direct conventional laryngoscopy in difficult situations. *Methodology:* It was a randomised controlled study. Preoperative assessment of difficult airway was done. Among the patients coming for elective surgery, the patients with difficult airway were chosen. Hundred such patients were selected as per the inclusion criteria. They were divided into two groups with fifty patients in each group. Group A was direct conventional laryngoscopy, the control group. Group B was video laryngoscopy, the study group. During intubation, several parameters were noted. Cormack Lehane view, number of intubation attempts, time for intubation, oral trauma etc were noted. *Result:* Cormack Lehane view was better in VL. Number of attempts was lesser in VL than in DCL. Time for intubation was lesser in DCL. *Conclusion:* For successful intubation, the number of attempts was lesser in VL. Hence VL could be a better tool in difficult airway management.

Keywords: Difficult airway; Direct conventional laryngoscopy; Video laryngoscopy.

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Introduction

It is mandatory for all the anaesthetists to have an uncompromised skill of laryngoscopy and tracheal intubation. Direct conventional laryngoscopy is the use of the laryngoscope to visualize the larynx under direct vision. Video laryngoscopy is the indirect visualization of the larynx by using camera and video screen display.

For majority of the anaesthetists, Macintosh is the first choice of blade. Macintosh laryngoscopy has been the gold standard [1]. The DCL and VL which are used in our study have Macintosh blade. We used the video laryngoscope (C-MAC®) attached with a Macintosh blade and a colour video display.

The aim of the study is to find out whether the recently developed Video laryngoscopy will be more helpful than the Direct conventional laryngoscopy in the management of difficult airway.

This study compared the Cormack Lehane View, number of attempts for successful tracheal intubation and time taken for intubation. The study

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was done in patients with anticipated difficult intubation coming for elective surgery.

Cormack- Lehane grading of direct laryngoscopy cannot be related to the ease of endotracheal intubation. Even with grade 1 or grade 2 views of Cormack and Lehane, the introduction of the endotracheal tube may be difficult sometimes. So the successful placement of endotracheal tube in minimal time is the required goal [2]. Hence in our study we assessed the success rate of endotracheal tube placement by counting the number of attempts for correct placement of endotracheal tube and the duration taken by the anaesthetist for tube placement.

For the past 75 years, DCL has been considered as a gold standard for direct visualization of larynx and endotracheal intubation. Video laryngoscopy though reached anaesthesia practice recently, can also be considered as a standard method of intubation [3]. Several studies are going on universally to assess the role of video laryngoscope.

Methodology

Study design: Randomised Controlled Study.

Study population: Patients with ASA grade I and II, aged 18-65 years, of both sex scheduled for surgery under general anaesthesia, with difficult airway condition.

Inclusion criteria: Patients with difficult airway (Mallampati grade III, Upper lip bite test Score II and III, Neck mobility score III).

Exclusion criteria: Patients below 18 years of age, huge thyroid patients, patients with valvular and ischaemic heart diseases. Also patients who did not give written consent were excluded.

Study variables:

- Glottic view
- Number of attempts for tube placement
- Time taken for intubation
- Trauma during intubation
- External laryngeal manipulation
- Haemodynamic changes

Sample size

Comparison of time taken for intubation under different method

Sample size has been calculated from the following formula:

$$N = \frac{2(Z_\alpha + Z_\beta)^2\sigma^2}{\Delta^2}$$

Where $Z_\alpha = 1.96$ for $\alpha = 0.05$

$Z_\beta = 0.84$ for $\beta = 0.20$

$\Delta = \mu_T - \mu_C$ (difference in mean)

σ = Standard deviation

In this study:

Standard deviation of time taken for intubation (σ) =35.4

Difference in time taken for intubation between groups (Δ) = 20

So minimum sample size is 50 from each group

Method of study

Following routine pre-anaesthetic check up by the attending anaesthesiologist, patients were categorised using Modified Mallampati scoring, neck extension and upper lip bite test.

After establishing venous access, standard monitoring, premedication and preoxygenation, general anaesthesia was induced using propofol (mean dose 2.0 mg/kg), fentanyl (mean dose 2.0 µg/kg) and vecuronium (mean dose 0.1 mg/kg).

After mask ventilation with the patient in the sniffing position, laryngoscopy was performed with a Macintosh direct laryngoscopy blade or Videolaryngoscopy according to the allocation, by an anaesthesiologist who is blinded to the results of preoperative airway assessment. Glottic visualisation was assessed and noted with either direct laryngoscopy or videolaryngoscopy with the Cormack and Lehane classification.

External laryngeal pressure was applied in the needed cases. View of the glottis, time taken for intubation, number of intubation attempts, need of external laryngeal pressure, haemodynamic changes and blood in oral cavity before extubation were assessed and recorded, on both groups.

Statistical Analysis:

The collected data were entered into Microsoft excel. Then data was analysed using SPSS software.

Quantitative variables were expressed in mean and standard deviation.

Qualitative variables were expressed in frequency distribution.

Comparison of quantitative variables was done by Student's 't' test.

Comparison of qualitative variables was done by Chi-square test.

A 'p' value of <0.05 was considered as the level of significance.

A 'p' value of >0.05 was considered as not significant.

Results

All the patients were able to complete the entire study. Data from all the 100 patients were analyzed.

Video Laryngoscopy is having significantly better view than Direct Laryngoscopy. Out of the 50 patients of each group, Video Laryngoscopy had Grade 1 Cormack Lehane view on more than 95% cases excluding the laryngeal manipulation given for the better view (Chart 1).

Number of attempts needed for tracheal intubation with Video Laryngoscopy is significantly lesser than Direct Laryngoscopy. Out of the 50 cases, second attempt for Video Laryngoscopy was needed for 5 cases only and third attempt was not needed at all (Chart 2).

Table 1: Comparison of Cormack Lehane View

Cormack Lehane View	Device				Total		χ^2	df	p
	DCL		VL						
	N	%	N	%	N	%			
Grade 1	2	4	49	98	51	51			
Grade 2	24	48	1	2	25	25	88.474	2	<0.001
Grade 3	24	48	0	0	24	24			
Total	50	100	50	100	100	100			

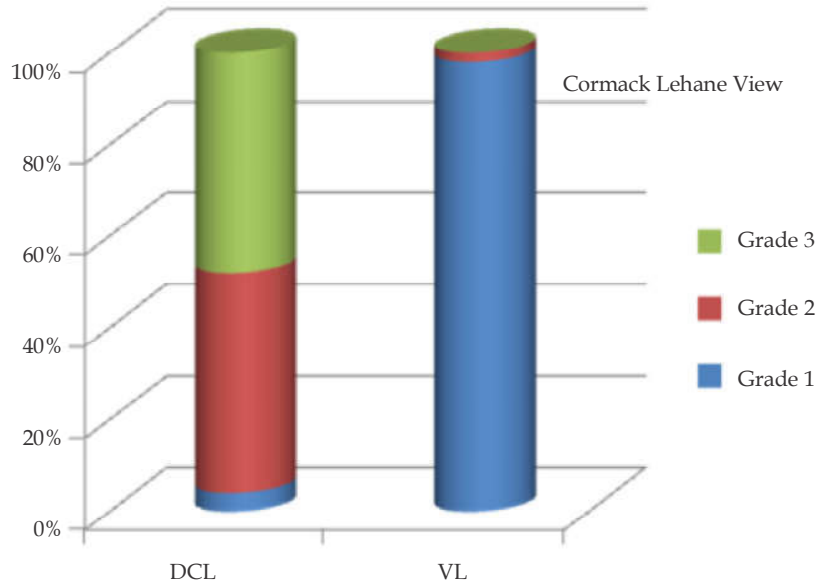

Chart 1: Comparison of Cormack Lehane View

Table 2: Comparison of Number of Attempts needed for intubation

Number of Attempts	Device				Total		χ^2	df	p
	DCL		VL						
	N	%	N	%	N	%			
1	22	44	45	90	67	67			
2	21	42	5	10	26	26	24.742	2	0
3	7	14	0	0	7	7			
Total	50	100	50	100	100	100			

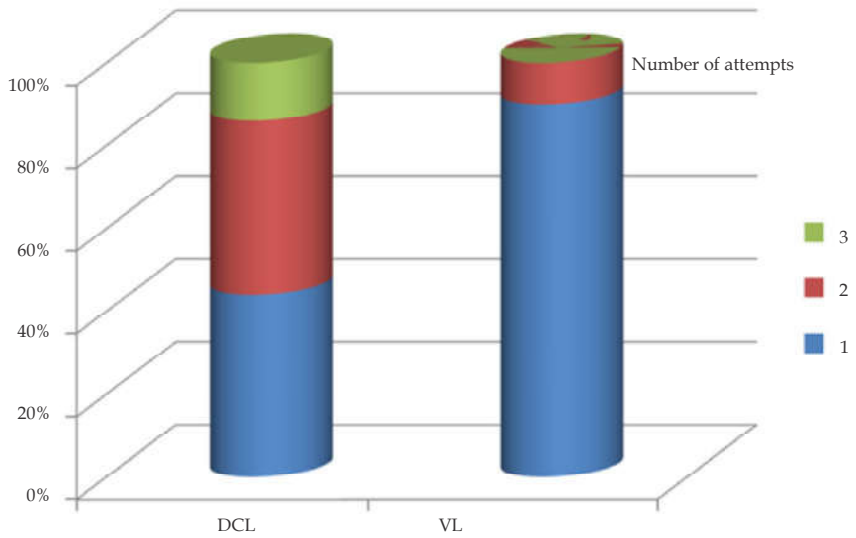

Chart 2: Comparison of number of attempts for Intubation

Table 3: Comparison of time taken for intubation

Group	N	Time Taken For Intubation in seconds		t	p
		Mean	SD		
DCL	50	35.18	4.217	2.783	0.006
VL	50	37.82	5.216		

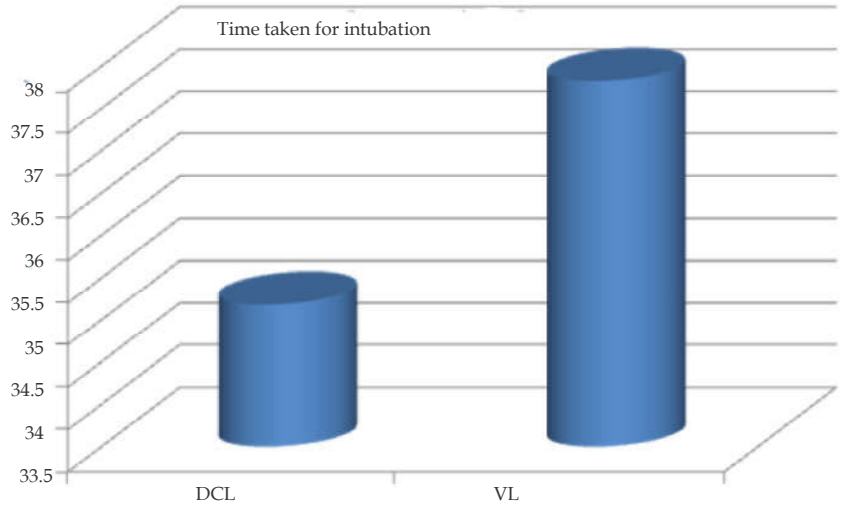

Chart 3: Comparison of Time taken for Intubation

Table 4: Comparison of External laryngeal manipulation

External laryngeal manipulation	Device				Total		χ^2	df	p
	DCL		VL						
	N	%	N	%	N	%			
Yes	47	94	10	20	57	57	55.855	1	0
No	3	6	40	80	43	43			
Total	50	100	50	100	100	100			

The time taken for tracheal intubation (from opening of the mouth to inflating the cuff) was shorter for Direct Laryngoscopy than Video Laryngoscopy (Chart 3).

External laryngeal manipulation was needed only in 10 cases with Video Laryngoscopy, which is significantly better than Direct Laryngoscopy (Chart 4).

Change in heart rate after Video Laryngoscopy is lesser than that after Direct Laryngoscopy (Chart 5).

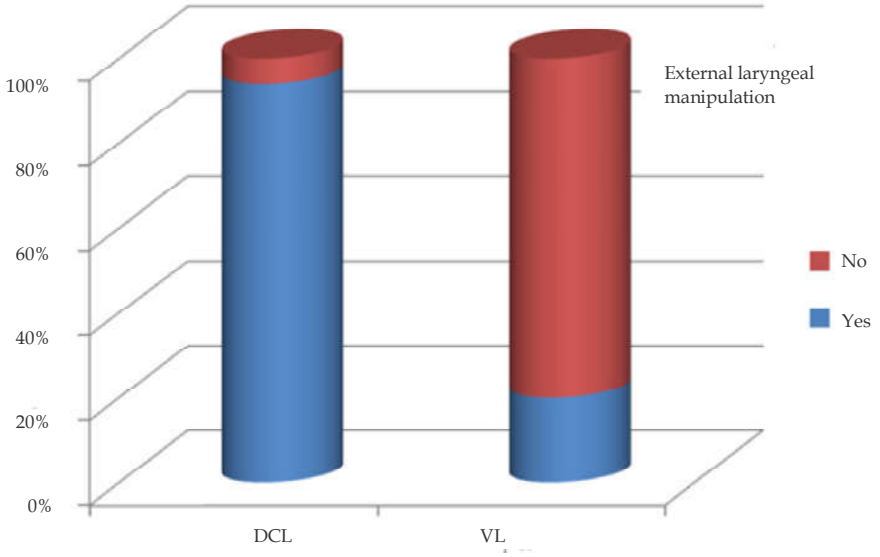

Chart 4: Comparison of External laryngeal manipulation

Table 5: Comparison of Post Laryngoscopic Haemodynamic Changes

	DCL		VL		p-value
	Mean	SD	Mean	SD	
Pre Induction HR	74.84	6.55	74.34	5.23	0.005
Post laryngoscopic HR	77.82	6.42	74.92	4.36	
Pre Induction SBP	137.84	7.35	136.9	7.65	0.000
Post laryngoscopic SBP	123.60	14.84	109.42	13.85	
Pre Induction DBP	79.84	6.96	78.84	7.81	0.03
Post laryngoscopic DBP	73.94	12.74	66.24	56.09	

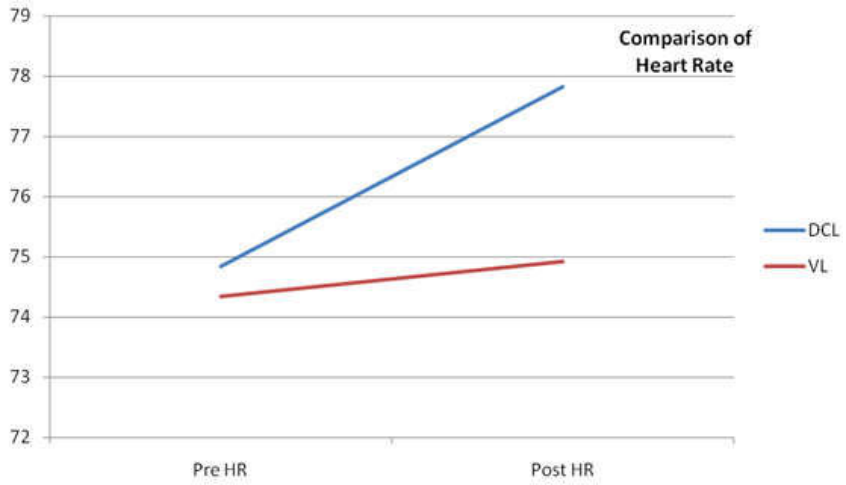

Chart 5: Comparison of Post Laryngoscopic Heart rate Changes

Rise in blood pressure after Video Laryngoscopy is lesser than that after Direct Laryngoscopy (Chart 6).

Trauma is minimal in Video Laryngoscopy than Direct Conventional Laryngoscopy (Chart 7).

Table 6: Comparison of Post operative blood in oral cavity

Post Operative Blood in Oral Cavity	Device				Total		χ^2	df	p
	DCL		VL						
	N	%	N	%	N	%			
Minimal	45	90	50	100	95	95	5.263	1	0.022
Moderate	5	10	0	0	5	5			
Total	50	100	50	100	100	100			

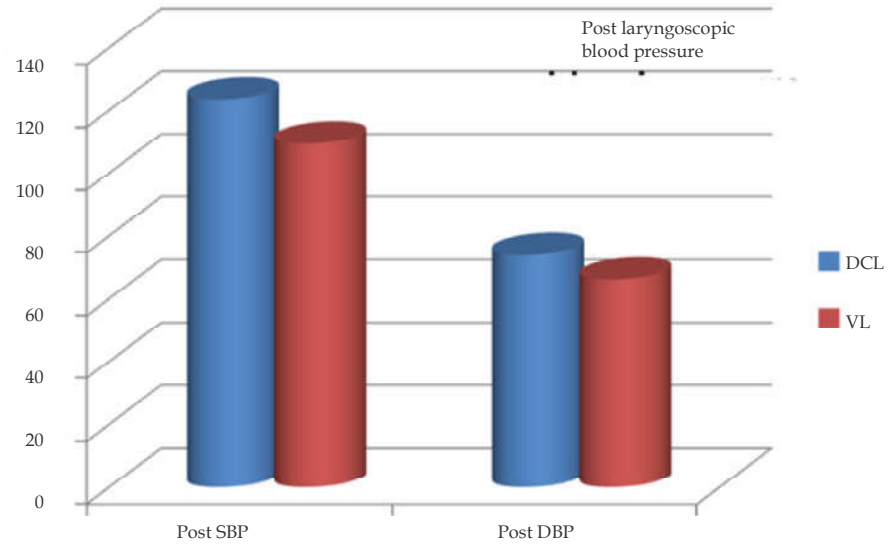

Chart 6: Comparison of Post Laryngoscopic Blood Pressure

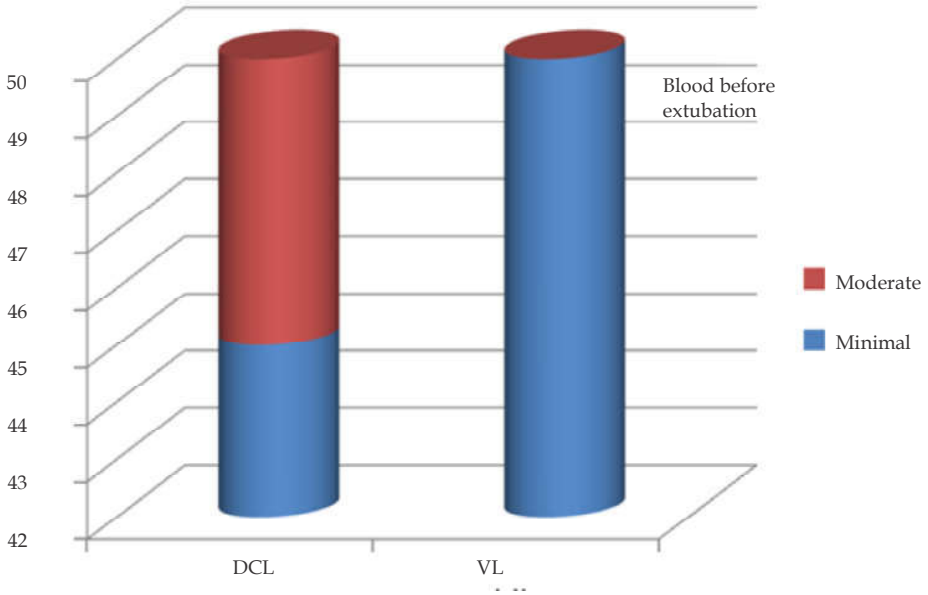

Chart 7: Comparison of Postoperative blood in oral cavity

Discussion

Our study through its results revealed several things which are relevant in difficult airway situations. Video laryngoscopy presents a very good view of the vocal cords. Video laryngoscopy elevated the success of correct tube placement. Video laryngoscopy slightly increased the duration of intubation.

VL could be quickly learned, but requires some practice. It is very much essential that the operators be familiar with the device they are using [4].

Single predictors like Modified Mallampati Score or Upper lip bite Test won't be sufficient enough to correctly predict the difficult airway in all the patients [5]. So the three predictors Modified Mallampati Test, Upper Lip Bite Test and Neck Extension Grade were used to predict the difficult airway.

There are several optimising manoeuvres during laryngoscopy to facilitate endotracheal intubation. External laryngeal manipulation was the optimising manoeuvre used in our study. The optimizing manoeuvre needed with Video Laryngoscopy was significantly lower than Direct Laryngoscopy.

Study participants were not very familiar with VL. This lack of experience using video laryngoscopy may account for the increase in time to intubation.

Though an equal or improved view of the cords are seen, intubation time is increased in neck immobility scenarios in ours as well as other studies [6,7,8,9]. One study noted that manoeuvring the tube was the barrier to successful intubation [6]. This was also demonstrated in a study with anaesthetist in the operation theatre setting, which found that there was an improved view with video laryngoscopy compared with Macintosh laryngoscopy when the Cormack Lehane grade was >1. The designer of the instrument suggests curving the endotracheal tube with stylet in situ. The curvature should be 60 degree. This angle of curvature will match the curvature of the blade [6]. Few more methods are also suggested for easy passage and successful placement of the tube. A more rigid stylet can be used. The stylet can be bent like a hockey stick i.e., a 90 degree curvature at the distal end. Also a rigid stylet with flexible tip can be used [6,10,11,12].

During our study we also find difficulty in directing the endotracheal tube to the vocal cords, even with Cormack Lehane grade 1 view. This could be due to interference by the soft tissues or cartilages of the laryngeal architecture.

Manipulation of the endotracheal tube orientation is often not sufficient because of the insufficient curvature of the distal end of the endotracheal tube; in such cases, an extra tool like stylet is necessary [13]. By regular practice we found the method of insertion through bending the stylet along with the curvature of blade. Later on there was significant reduction in time compared to the earlier cases. Our study got decreased time for DCL than VL. But on regular practice with Video Laryngoscopy, there was improved laryngeal exposure and first attempt success rate. Also there was gradual reduction of tracheal tube insertion time.

In a study by Stroumpoulis [14], the rate of failed intubation using Video Laryngoscopy in 112 patients with predictors of a difficult airway was only 2%. Jungbauer et al., could place endotracheal tube successfully in 99% of their cases [15]. Their patients had a Mallampati score of 3 or 4. They used Macintosh video laryngoscope for their study. Kaplan et al., also used Macintosh video laryngoscope. They found an enhanced laryngoscopic view in their patients. They could not intubate in only 0.3% of their patients [16].

It is more distinct in difficult airway scenarios where the video Laryngoscopes are most beneficent for achievement of successful intubation. One group of students studied had greater ease of intubation and successful intubation using the Video Laryngoscope in simulated Cormack Lehane grade 3 airways [9].

Force applied to the maxillary incisors during the intubation in difficult airway is a potential cause for dental injury in patients with prominent maxillary teeth or loose tooths [17]. A study found that, the forces applied on maxillary teeth while intubation is less with Video laryngoscope than with Direct Laryngoscope [18]. During our study also it was evident. We have very few cases of dental or lip injuries with Video Laryngoscopes patients with difficult airways.

The regular use of the Video Laryngoscope eases tracheal intubations in patients with expected difficult airway. The view of the laryngeal entrance for guiding endotracheal tube is significantly improved, with a decreased number of optimizing manoeuvres. Overall, the improvement of the conditions for tracheal intubation results in a significantly higher success rate of tracheal intubations.

The Direct Conventional laryngoscopy (DCL) and Video Laryngoscope (VL) have unique advantages as well as disadvantages. DCL is an established method tested across a long period. It is

less expensive. The instrument is easy to carry. The malfunction of the instrument occurs very rarely. Fluid or warm air has less impact on the function of DCL. It has high success rate though experience is counted. Even without perfect visualization of the larynx, the intubation can be attempted. DCL does not end up in successful intubation in all the cases. There are failures also. The failure rate is around 1%.

The video laryngoscopy has some advantages than DCL. All the axes of airway need not be aligned in a straight line. Intubation could be attempted even when the axes of airway are in different vectors [19,20]. In restricted mouth opening, VL has better view than DCL. In the situation of restricted neck movements viz., cervical spine arthritis and trauma, VL gives better view than DCL. VL is a very good teaching tool. The view could be demonstrated to other people. Since the assisting persons also visualize the airway simultaneously, they will be in a position to lend help in a much more constructive and useful way rather than blindly. VL is having a higher success rate than DCL in all types of cases. In difficult airway, the success rate of VL is remarkably higher than DCL. The airway anatomy of the dummies, cadavers and live individuals could be taught in an impressive way to the students where in the depth of understanding the concept is definitely high. For awake intubation, VL is better than DCL since manipulation is less. The trainee who starts with VL will have a shorter learning curve for DCL as well. The incidence of oesophageal intubation is less in VL comparing with DCL. The lesser degree of manipulation in VL leads to lesser chances of oral trauma and laryngeal trauma than DCL. The worsening of unstable cervical spine is nil or very minimal in VL. The stimulation of sensitive structures of larynx is minimal in VL. This results in lesser haemodynamic responses than in DCL. In DCL, rise in heart rate and blood pressure is high during and after intubation.

VL is not without disadvantages. Some people have relatively longer learning curve. The unfamiliarity of VL can lead to a longer intubation time. Many times stylet is needed though VL gives a good view of the airway. Secretions or warm air at the tip of the VL can result in distorted view of the airway.

In VL, the visualization of the airway is achieved through a screen display. Due to this, the real dimension and orientation of the airway could not be perceived well. VL has electrical, electronic and optical components. Hence handling of VL is cumbersome. Also because of involvement of multiple components, there are more chances of malfunction of the instrument. The cost of VL is very high comparing with that of DCL. The trainees who handle exclusively the VL will lose the art of DCL which is a time tested technique. VL is marketed by different companies. There are some differences between the VL of each company. So each VL needs some learning curve. A person who is having a very good experience in DCL need not have a higher successful intubation with VL, since the optics and mechanics differ. Multiple factors affect the display in VL. The acceptance of VL by the anaesthetists varies widely. It depends largely on the attitude and mindset. People who are fond of gadgets accept VL in a comfortable way. People who are wary of gadgets are wary of VL also.

At present the cost of VL is high, but the price will come down with increased quantity of manufacture. Similarly the repair cost of VL is very high at present, but will come down with widespread usage. The major advantage of VL is a very good glottic view. It is desirable to get familiar with both DCL and VL. This will improve the management of airway especially in difficult situations.

Conclusion

VL is an ideal tool in Institutions, Operation Theatres, Casualty Departments and Critical Care Units for learning and teaching endotracheal intubation. Several researches could be done in airway management with Video Laryngoscope as a tool. Many studies proved the advantages of Video Laryngoscopes in difficult airway scenarios which includes the decrease in number of attempts, first attempt success and better grades of Cormack Lehane view. Ultimately this can significantly decrease the anaesthesia related morbidity and mortality. Hemodynamic responses significantly decreased with Video Laryngoscopy because of the first attempt success. Airway trauma related to repeated laryngoscopy is avoided by Video Laryngoscopy. Even though our study shows increased time for Video Laryngoscopy, it may be due lack of experience with Video Laryngoscope. Regular practice in difficult airway scenarios with Video Laryngoscopy will decrease the time for intubation than that of Direct Laryngoscopy.

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Conflict of interest: Nothing to declare.

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