e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(10); 621-626

Original Research Article

Videolaryngoscopes are Becoming a New Breakthrough in Airway Management

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Received: 25-07-2023 / Revised: 28-08-2023 / Accepted: 30-09-2023
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Conflict of interest: Nil

Abstract:

Background: Difficulties in airway management increase the risk of hypoxia, which can also lead to devastating neurological outcome.

Objectives: To compare Macintosh laryngoscope, Truview video laryngoscope and King Vision video laryngoscope with respect to time to intubation, Cormack- Lehane grading, number of attempts, optimisation manoeuvres required and the complications related to laryngoscopy and intubation.

Methods: After obtaining approval from the Institutional Ethic Committee, the present, prospective, cross over randomized study "evaluating the efficacy of Kingvision, trueview and Macintosh video laryngoscope in patients requiring general anesthesia with endotracheal intubation." was conducted in the Post-Graduate Department of Anaesthesiology and Intensive care, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu over a period of one year. 120 patients undergoing elective surgery requiring tracheal intubation were randomly as-signed to undergo intubation using Kingvision, Truview or Macintosh laryngoscope, to compose equal groups of 40 each.

Results: Majority of patients in all three groups had MPG I/II. Kingvision group (31; 77.5%), Truview group (35;87.5%) and Macintosh group (35;87.5%). 8 patients in Kingvision group and 5 patients each in Truview and Macintosh group had MPG III/IV indicating the difficulty in intubation. The three groups were comparable with relation to MPG distribution. ($p>0.05$). Cormack Lehane Grade I (full view of vocal cords) was seen in 40 (100%) patients of the Kingvision group, 37(92.5%) of the Truview group and 28(70%) of the Macintosh group. Grade II (partial view of vocal cords) was seen in no patient of Kingvision group, 6(15%) of Truview group and 10 (25%) of the Macintosh group.

Conclusion: Both the video laryngoscopes were found to be significantly better than the Macintosh laryngoscope in terms of Cormack and Lehane grading; requirement of optimisation manoeuvres and need of second attempt for intubation.

Keywords: Kingvision, trueview and Macintosh video laryngoscope, Mallampati Grading, Difficult intubation, Cormack lehane grading.

Introduction

Endotracheal intubation is critical for securing the airway in various situations. It is being practiced since its inception into anaesthetic practice by Rowbotham and Magil in 1921.[1] It is considered the best method for management of the airway under a variety of circumstances, as it provides the most reliable means of oxygenation and ventilation and besides providing greatest protection against regurgitation and aspiration of pulmonary contents. However, tracheal intubation requires a lot of clinical expertise and experience to master; serious complications may occur when not performed properly.[2]

Difficulties in airway management increase the risk of hypoxia, which can also lead to devastating neurological outcome. The American Society of Anaesthesiologists Closed Claim study showed that difficult intubation or oesophageal intubation is the cause of approximately 35% of life-threatening respiratory events, including death and permanent brain damage.[3]

Despite efforts to predict a difficult airway pre-operatively there remain unanticipated difficult intubations. Various tests are performed prior to anaesthesia, for predicting difficult intubation, for example the Mallampati or Wilson index test.[4] The Mallampati score, based on the view of the soft palate when the patient opens their mouth, is the

most widely used predictor of difficult intubation; but this and other prediction tests have been shown to have low positive predictive values for difficult intubation.[5]

Although various types of laryngoscopes such as Miller, Mc Coy, Bellscope etc. with different technical specifications and operational features are available, Macintosh is the most widely used intubation device since it was introduced by Foregger in 1940.[6] However, whilst these laryngoscopes may be adequate to move soft tissue the anaesthesiologist still requires line of sight to the larynx between the operator and the laryngeal inlet, provided by correct head and neck positioning of the patient. In conditions where positioning is not possible e.g. in poor tissue mobility, limited mouth opening, enlarged tongue; the chances of direct laryngoscopy failure increases.

Videolaryngoscopy is a newly developed technique to improve tracheal intubation success. It was made to bypass the need of directly visualising the glottic inlet. Both direct laryngoscopes and video-laryngoscopes comprise of a handle and a blade. However, there is a video camera fitted at the end of the video laryngoscope blade, facilitating visualization of the glottis indirectly on a screen. Both types of laryngoscopes have common features, so that physicians who are familiar to use DL can use VLs with minimal added training.

Keeping in view the rationale behind the study on Videolaryngoscopy; in this prospective study, we propose to compare Macintosh laryngoscope, Truview video laryngoscope and King Vision video laryngoscope with respect to time to intubation, Cormack- Lehane grading, number of attempts, optimisation manoeuvres required and the complications related to laryngoscopy and intubation.

Materials and Methods

After obtaining approval from the Institutional Ethic Committee, the present, prospective, cross over randomized study "evaluating the efficacy of Kingvision, trueview and Macintosh video laryngoscope in patients requiring general anesthesia with endotracheal intubation." was conducted in the Post-Graduate Department of Anaesthesiology and Intensive care, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu over a period of one year. 120 patients undergoing elective surgery requiring tracheal intubation were randomly assigned to undergo intubation using Kingvision, Truview or Macintosh laryngoscope, to compose equal groups of 40 each. All intubations were performed by a senior anesthesiologist who has an experience of at least 40 intubations in patients using VL.

After obtaining informed written consent from patients, they were allocated into one of the 3 study groups randomly according to a computer-generated table of randomisation, each group comprising of 40 patients.

- GROUP I (n=40): Patients in this group were intubated using Kingvision videolaryngoscope standard (non channelled) blade.
- GROUP II (n=40): Patients in this group were intubated using Truview videolaryngoscope.
- GROUP III (n=40): Patients in this group were intubated using Macintosh Laryngoscope.

Inclusion Criteria

1. Patients of either sex
2. Age 20-70
3. ASA grade 1 and II
4. MPG 1, 2, 3, 4

Exclusion Criteria

The following patients were excluded in this study:

1. Patient refusal
2. Age < 20 and > 70 years
3. ASA III and IV
4. Patients with risk of pulmonary aspiration of gastric contents (e.g. pregnancy, diabetes)
5. Patients with history of cardiovascular disorder
6. Patients with raised intracranial pressure.

Methodology

After adequate pre-oxygenation, standard general anaesthetic techniques were followed in all 3 groups using Injection Fentanyl 1microgram/kg and Injection Propofol 2mg/kg intravenously. Muscle relaxation was achieved with Injection Succinyl-choline 1mg/kg intravenously. Intubation was attempted after 60 seconds of giving Injection Succinylcholine. All the intubations were done by the same experienced anaesthesiologist and the head was kept in "neutral position". Stylet was used for intubation in all 3 groups. Size 3 of Macintosh and Kingvision standard (non-channelled) blade and medium-sized Truview blade were used for patients up to 50 kg. Size 4 of Macintosh blade, size 3 kingvision standard (non-channelled) blade and large sized Truview blade were used for patients having more than 50kg weight.

After successful intubation anaesthesia was maintained with 33% Oxygen & 66% Ni-trous Oxide mixture & varying concentrations of Isoflurane (1-1.5%). Neuromuscular blockade was maintained by Injection Rocuronium 0.15 mg/kg. After completion of the surgery neuromuscular blockade was reversed with – Injection Neostigmine 0.05mg/kg and Injection Glycopyrrolate 0.01mg/kg.

Following Parameters were recorded and compared:

1. Time to intubation- time elapsed from insertion of the blade between the dental arches to the first deflection on capnography.
2. Evaluation of Glottic view using Cormack lehane grading
3. Number of attempts and optimization maneuvers required-
4. After intubation & post-extubation- blade of the laryngoscopes was checked for blood staining; along with inspection of any trauma to tongue, teeth or soft tissues.

Statistical Analysis

At the end of the study all the data was compiled and analyzed statistically. Comparison of mean value among the three groups was done using students t-test and percentage comparison was done using the chi square test.

To compare more than two variables ANOVA test was used. The P value of less than 0.05 was considered statistically significant.

Results

Table 1: Age and Sex wise distribution of patients

		Group			Total
	Age Group (in years)	**KINGVISION (I)**	**TRUVIEW (II)**	**MACINTOSH (III)**	
Age	20 - 30	10	8	4	22
		25.00%	20.00%	10.00%	18.30%
	31 - 40	13	15	14	42
		32.50%	37.50%	35.00%	35.00%
	41 - 50	10	10	14	34
		25.00%	25.00%	35.00%	28.30%
	51 - 60	6	7	8	21
		15.00%	17.50%	20.00%	17.50%
	61+	1	0	0	1
		2.50%	0.00%	0.00%	0.80%
Total		40	40	40	120

As per table 1 Majority of the patients were in the age group of 20-50 years; Kingvision (33;82.5%), Truview (33;82.5%) and Macintosh (32;80%). Mean age ±SD in Kingvision group was 39.65±11.51years, Truview group was 40.05±10.59 years and in Macintosh group was 41.22 ±9.24. All three groups were comparable with respect to mean age (p=0.784). Female patients dominated the Kingvision group while male dominated the other two groups. Male to female ratio was 0.90:1, 1.22:1, 1.85:1 respectively in the 3 groups.

Table 2: Distribution of patients according to Mallampati Grade

		Group			Total
		KINGVISION (I)	**TRUVIEW (II)**	**MACINTOSH (III)**	
MPG	I	23	23	21	67
		57.5%	57.5%	52.5%	55.8%
	II	9	12	14	35
		22.5%	30.0%	35.0%	29.2%
	III	7	4	4	15
		17.5%	10.0%	10.0%	12.5%
	IV	1	1	1	3
		2.5%	2.5%	2.5%	2.5%
Total		40	40	40	120

p-value- 0.879

As per table 2 Majority of patients in all three groups had MPG I/II. Kingvision group (31; 77.5%), Truview group (35;87.5%) and Macintosh group (35;87.5%). 8 patients in Kingvision group and 5 patients each in Truview and Macintosh group had MPG III/IV indicating the difficulty in intubation. The three groups were comparable with relation to MPG distribution. (p>0.05).

Table 3: Comparison of mean time of intubation in the three groups

Mean Time of Intubation In Sec.	**KINGVISION (I)**	**TRUVIEW (II)**	**MACINTOSH (III)**
	MEAN ±SD	MEAN ±SD	MEAN ±SD
	8.95±1.853	8.95 ±1.81	9.7±1.4
		0.138	
Statistical inference	0.083	Not significant[b]	0.077
(Unpaired t test)	Not significant[a]		Not significant[c]

[a]Kingvision vs Truview; [b]Kingvision vs Macintosh; [c]Truview vs Macintosh

The mean time of intubation was comparable between Kingvision and Truview group (8.95 VS 8.95 sec; p=0.083), between Kingvision and Macintosh group (8.95 VS 9.7 sec; p=0.138) and between Truview and Macintosh groups (8.95 VS 9.7; p=0.077)

Table 4: Comparison of the three groups according to Cormack and Lehane Grading

		Group			Total
		KINGVISION (I)	TRUVIEW (II)	MACINTOSH (III)	
Cormack Lehane Grading	I	40	37	28	105
		100.0%	92.5%	70.0%	87.3%
	II	0	2	10	12
		.0%	7.5%	25.0%	10%
	III	0	1	2	3
		.0%	2.5%	5.0%	2.5%
	IV	0	0	0	0
Statistical inference (Fisher's Exact Test)		P=0.12 Not significant[a]	P=0.002 Significant[b]	P=0.034 Significant[c]	
Total		40	40	40	120

As per table 4 Cormack Lehane Grade I (full view of vocal cords) was seen in 40 (100%) patients of the Kingvision group, 37(92.5%) of the Truview group and 28(70%) of the Macintosh group. Grade II (partial view of vocal cords) was seen in no patient of Kingvision group, 6(15%) of Truview group and 10 (25%) of the Macintosh group. Grade III (only epiglottis visible) was observed in 1 patient (2.5%) in Truview and 2 (5%) patients in the Macintosh group. Grade IV (neither the epiglottis nor glottis seen) was seen in none of the patients. Statistically, the difference was not significant be-tween the Kingvision and Truview (p=0.12) groups However, it was significant be-tween the Kingvision and Macintosh groups (p=0.02) as well as between the Truview and Macintosh group (p=0.034).

Table 5: Comparison of number of attempts at intubation

		Group			Total
		KINGVISION (I)	TRUVIEW (II)	MACINTOSH (III)	
Number of attempts	1	38	37	33	108
		95.0%	92.5%	82.5%	90.0%
	2	2	3	7	12
		5.0%	7.5%	17.5%	10.0%
Statistical inference (Fisher's Exact Test)		P=0.082 Not significant[a]	P=0.0324 Significant[b]	P=0.882 Not significant[c]	
Total		40	40	40	120

As per table 5 Intubation was successful in the first attempt in 38(95%) patients in the Kingvision group, 37(92.5%) patients in the Truview group and 33 (82.5%) patients in the Macintosh group. Statistically, the difference of number of attempts was comparable between Kingvision and Truview groups (p=0.082) and between Truview and Macin-tosh group(p=0.262). However, it was significant between Kingvision and Macintosh group and Truview and Macintosh group. Statistically, the difference of number of at-tempts at intubation was comparable among the three groups (p>0.05).

Table 6: Comparison of three groups according to number of optimization manoeuvres required

		Group			Total
		KINGVISION (I)	TRUVIEW (II)	MACINTOSH (III)	
Optimization Manoeuvres Required	No	38	36	33	107
		95.0%	90.0%	82.5%	89.2%
	Yes	2	4	7	13
		5.0%	10.0%	17.5%	10.8%
Statistical inference (Fisher's Exact Test)		P=0.081 Not significant[a]	P=0.033 Significant[b]	P=0.088 Not significant[c]	
Total		40	40	40	120

As per table 6 Use of optimization manoeuvres like bougie, cricoid pressure and second assistant was required in 2 (5%) patients in Kingvision group, 4(10%) patients in Truview group and 7(17.5%) patients in Macintosh group. Statistically, the difference in use of optimization manoeuvres was comparable between the Kingvision vs Truview group(p=0.081) and Truview vs Macintosh group. However, it was significant among the Kingvision and Macintosh groups (p=0.033).

Table 7: Comparison of three groups according to observed trauma

		Group			Total
		KINGVISION (I)	TRUVIEW (II)	MACINTOSH (III)	
Trauma	No	40	40	35	115
		100.0%	100.0%	87.5%	95.8%
	Yes	0	0	5	5
		.0%	.0%	12.5%	4.2%
Statistical inference (Fisher's Exact Test)		P=1.00 Not significant[a]	P=0.05 Not significant[b]	P=0.05 Not significant[c]	
Total		40	40	40	120

As per table 7 Trauma was observed in 5 patients in the Macintosh group. No patient underwent any trauma in each of the Kingvision and Truview group. Statistically, the difference among the three groups was not significant; (p=1.00) between the Kingvision VS Truview group and p=0.05 in both Kingvision VS Macintosh and Truview VS Macin-tosh.

Discussion

Video laryngoscopes have been recently developed and become popular as new tools to combat unanticipated difficult airway. These devices help to visualize the larynx without alignment of the oral, laryngeal and pharyngeal axes. The present study was conducted to compare King vision video laryngoscope, Truview video laryngoscope and Macintosh laryngoscope in patients undergoing surgery under general anesthesia with respect to the duration of intubation, Cormack Lehane grading, number of attempts and optimization manoeuvres required and the hemodynamic response. A total of 120 patients of either sex fulfilling inclusive criteria were randomly distributed in equal numbers to three intubation groups.

The Truview video laryngoscope consists of an angulated blade combined to an integrated optical lens system which can be connected to a display monitor. This provides an optimal indirect view of the glottis.[7]

In this study there was no difference between the three groups with regard to mean age, ASA physical status and Mallampati grade. Majority of the patients were in age group of 20-50 years in all the groups; Female predominance in the Kingvision group and Male predominance in the Truview and Macintosh Groups. In all the three groups ASA class I patients predominated. All grades of Mallampati classification were included in the study as single usage would have limited the discriminative power for difficult intubation.

In the current study, mean time of intubation was comparable between Kingvision and Truview group (8.95 VS 8.95 sec; p=0.083), between Kingvision and Macintosh group (8.95 VS 9.7 sec; p=0.138) and between Truview and Macintosh groups (8.95 VS 9.7; p=0.077). The duration of intubation was comparably lesser in the Kingvision and Truview group than the Macintosh group although it was not statistically significant (p>0.05). The reason cited was although videolaryngoscopes offer superior visualisation of the glottis; a good laryngeal view does not guarantee easy or successful tracheal tube insertion. This is because the laryngeal axes are not aligned in videolaryngoscopy, and the tip of the tracheal tube must therefore pass around a relatively acute angle to enter the larynx. This phenomenon is linked to video laryngoscopes with hyper angulated blades, unlike the traditional Macintosh blade.[8] Although Cormack Lehane grade I was achieved in majority of patients undergoing intubation with video laryngoscopes but less space is created for tube insertion when using the King vision as the pharyngeal tissues are not displaced far anteriorly. Also contrary to our observation, Barak M et al [9] and Nasim S et al [10]. found that Truview EVO2 laryngoscope took longer time for intubation than Macintosh laryngoscope. This may be attributed to greater experience of anesthesiologists with Direct laryngoscopy. Although the participating anesthesiologists had a good experience using the Truview laryngoscope prior to the study; their experience with Truview was comparatively less than that with Macintosh.

In the present study, decrease in the Cormack lehane grading was comparable between the Kingvision and Truview (p=0.12) groups. However, it was statistically significant between the Kingvision and Macintosh groups(p=0.02) as well as between the Truview and Macintosh group(p=0.034). This is because video laryngoscopes provide better glottis exposure when compared to direct laryngoscopy. The reason is due to presence of a camera at the tip of the blade of a video laryngoscope that eliminates need of aligning the laryngeal, pharyngeal and oral axes.[11,12,13]

In the current study, use of optimisation manoeuvres like bougie, cricoid pressure and second assistant was required in 2 (5%) patients in the Kingvision group, 4(10%) patients in Truview group and 7(17.5%) patients in Macintosh group. Statistically, the difference in use of optimization manoeuvres was comparable between the

Kingvision vs Truview group(p=0.081)and Truview vs Macintosh group. However, it was significant among the Kingvision and Macintosh groups (p=0.033). The Kingvision group performed better than the Macintosh group (p<0.05). This is because video laryngoscopes provide an indirect view of vocal cords on an LCD screen of lens, the tube needs to be blindly inserted until it can seen on the video laryngoscope screen, so some manipulation may be required while in case of direct laryngoscope the oral, laryngeal and pharyngeal axes need to be in a straight line for which much more manipulation may be required. Also, the manipulation needs to be continued until the passage of the endotracheal tube to maintain the glottis view, making it difficult. Thus, more patients require the specific manoeuvres. S M Elhadi et al[14] reported that use of kingvision videolaryngoscope reduced the number of optimisation manoeuvres as compared to macintosh as seen in our study.

In the present study trauma was observed in 5 patients in the Macintosh group. No patient underwent any trauma in each of the Kingvision and Truview group. Direct laryngoscopy might require putting an undue pressure on gums, teeth and periglottic structures for maximum exposure of vocal cords causing trauma. M Kliene-Brueggeney et al[15] reported that use of video laryngoscopes lowers tissue trauma rates. Statistically, the difference among the three groups was however not significant. (p=1.00) between the Kingvision VS Truview group and p=0.05 in both Kingvision VS Macintosh and Truview VS Macintosh.

Conclusion

Although the duration of intubation was lesser in both the Kingvision and Truview video laryngoscope groups than the Macintosh group; the difference was not statistically significant. Both the video laryngoscopes were found to be significantly better than the Macintosh laryngoscope in terms of Cormack and Lehane grading; requirement of optimisation manoeuvres and need of second attempt for intubation.

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