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Original Article

Anaesthesia Section

Comparative Evaluation of King Vision Video Laryngoscope, McCoy and Macintosh Laryngoscopes in Patients Scheduled for Mucormycosis Surgery: A Randomised Clinical Trial

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ABSTRACT

Introduction: Mucormycosis, an aggressive fungal infection may result in a difficult airway owing to its inflammation. King Vision Video Laryngoscope (KVVL) is a useful addition to a difficult airway armamentarium. McCoy laryngoscope with hinged tip is well-known equipment of difficult airway cart. Conventional Macintosh laryngoscope dominates in anaesthesia practice. Standard, existing and contemporary devices were compared in difficult airways resulting from mucormycosis.

Aim: To compare the relative performance of KVVL, McCoy, and Macintosh laryngoscopes based on the ease of intubation and haemodynamic response in patients with mucormycosis.

Materials and Methods: The present study was a randomised clinical trial, conducted in a tertiary care government hospital, during June-August 2021 on 90 consenting patients of 18-65 years age, belonging to either sex with microbiologically confirmed mucormycosis undergoing debridement surgery. Group A was intubated with a non channeled KVVL, while group B had McCoy and group C had Macintosh laryngoscope. Primary outcome parameters were Cormack Lehane (CL) grade, time from laryngoscopy to successful intubation, number of attempts, any adjuncts or optimisation maneuvers, and any mucosal injury. Secondary outcome parameters were Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Blood Pressure (MBP) measured on arrival, before induction, after induction, and at 1, 2, 3, 5, and 7 minutes after intubation. Comparison of quantitative variables not normally distributed were analysed using Kruskal-Wallis test. Post-hoc analysis by Dunn's multiple pairwise comparison test. Friedman test followed by pairwise comparison was done to compare haemodynamic parameters within each group. Chi-square test was used for qualitative variables. The p-value $\leq$0.05 was considered to be statistically significant.

Results: The CL grade was lowest in group B (1.83±0.38) against group A (1.93±0.25), group C (2.13±0.35) with p-value of 0.029. Time from laryngoscopy to successful intubation was the least in group B (19.5±3.98 seconds) against group A (26.07±9.8 seconds), group C (21.33±3.74 seconds) with p-value of 0.002. No significant difference was there in the number of attempts, airway adjuncts/ optimisation maneuvers, mucosal injury. Haemodynamic variables were comparable.

Conclusion: McCoy laryngoscope was found to perform best in difficult airways resulting from mucormycosis. It was most effective for glottic visualisation, with the shortest time to successful intubation and, haemodynamic parameters were comparable to KVVL and macintosh laryngoscopes.

Keywords: Airway, Anaesthesia, Glottis, Haemodynamics, Intratracheal

INTRODUCTION

Mucormycosis is an aggressive angioinvasive infection of immunocompromised patients [1]. The estimated prevalence of mucormycosis in India is nearly 70 times that of worldwide data, at a median of 0.2 cases per 100,000 persons [2]. Rhino-Orbital Cerebral Mucormycosis (ROCM) is the frequently encountered variant, invading hard palate, paranasal sinuses, orbit and brain. An anaesthesiologist may encounter difficult mask ventilation and endotracheal intubation as a result of fungal debris in the oropharyngeal region, epiglottitis and supraglottic oedema [3].

Anaesthesiologists have many devices in their arsenal to manage a difficult airway, ranging from direct laryngoscopy with gum elastic bougie, lighted stylet, mcCoy laryngoscope, intubating laryngeal mask airway, fiber optic bronchoscope and various video laryngoscopes. There is an ongoing quest for new devices to facilitate optimal difficult airway management. McCoy improves glottic visualisation by virtue of its hinged tip which elevates epiglottis, requiring less neck movement and external laryngeal manipulation [4].

The KVVL with a light emitting diode and camera as part of the blade which may be a standard- non channeled requiring the use of a stylet to direct the tube, or a channeled, blade incorporating a guide channel for Endotracheal Tube (ETT) towards glottis [5]. Conventional macintosh laryngoscope is the gold standard for endotracheal intubation. It is the most ubiquitously used device despite vast advances in anaesthesia.

There are similar researches in literature, pertaining to the aforementioned three devices, in predicted difficult, normal as well as simulated airway scenarios. Several studies observed that video laryngoscopes perform better than others [4,6-10] in aiding endotracheal intubation. Studies that outline the management of airways that are made challenging due to various infective pathologies including mucormycosis have been published [3,11]. However, a comparison of intubation devices to evaluate their relative performance in this sub-group of patients has been lacking. Therefore, the present study aimed at comparing KVVL, mcCoy, macintosh in patients with ROCM undergoing surgical debridement at the study Institute, with the aim to ascertain the relative performance of one over the other. Primary outcome parameters measured were CL grade, time from laryngoscopy to successful intubation, number of attempts needed for intubation, any adjuncts or optimisation maneuvers required, and any resulting mucosal injury. Secondary outcome parameters were HR, SBP, DBP, Mean Blood Pressure (MBP), Oxygen Saturation (SpO_2), and Electrocardiogram (ECG).

MATERIALS AND METHODS

The present study was a randomised clinical trial, conducted in a tertiary care government hospital, during June-August 2021. The Institutional Ethics Committee (IEC) approved the study (proposal number IECHR-2021-50-4-R1), and the CTRI number is CTRI/2021/08/035912.

Sample size calculation: The sample size estimation was done based on a pilot study [4,6]. The proportion of patients with CL grade 2a in group A was 46.67%, group B was 80% and in group, C was 13.33%. CL grade was used as one of the primary outcomes and grade 2a signifies ease of vocal cord visualisation, hence this measure was incorporated for sample size calculation. Taking these values as a reference, the minimum required sample size, with 80% power of the study, and 5% level of significance was 29 patients in each study group. To reduce the margin of error, the total sample size taken was 90 (30 patients per group).

The formula used was:

$$n>=((pc*(1-pc)+pe*(1-pe))*(Z\alpha+Z\beta)2)/(pc-pe)^2$$

with pc=proportion of patients with CL grade 2a in one group, pe=proportion of patients with CL grade 2a in another group. $Z\alpha$ is the value of Z at the two-sided alpha error of 5% and $Z\beta$ is the value of Z at a power of 80%.

Inclusion criteria: American Society of Anaesthesiologists (ASA) classification I and II, aged 18-65 years of either sex, Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) negative for COVID- 19, and microbiologically confirmed mucormycosis.

Exclusion criteria: History of uncontrolled hypertension, cardiac or respiratory disease, pregnancy, morbid obesity, progressive neurological disease, and bleeding diathesis.

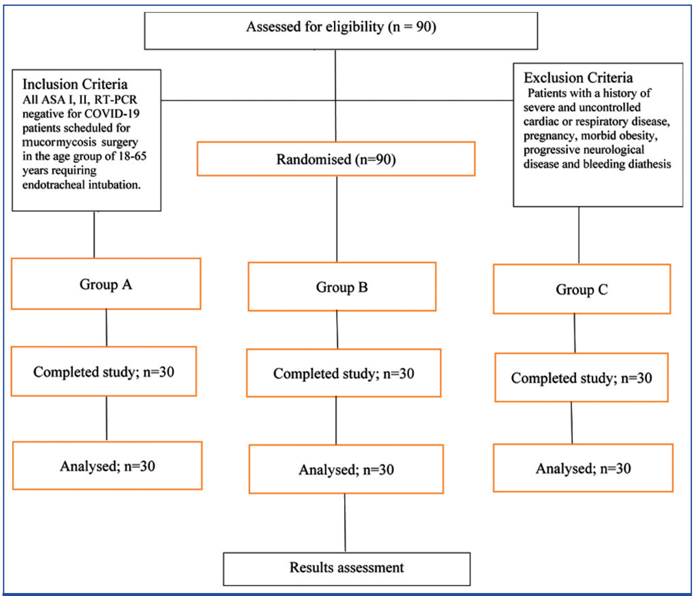
Patients were scheduled for various endonasal and external debridement procedures as well as orbital exenteration and decompression. A complete pre-anaesthetic checkup including predictors of difficult airway like mouth opening, inter-incisor distance, oropharyngeal space assessment, Mallampati Grade (MPG), Thyromental Distance (TMD), and neck mobility were performed.

Study Procedure

Patients were allocated to the three groups by a computer-generated random number table [Table/Fig-1]. A structured questionnaire was used for recording the airway parameters and haemodynamic data both before and after induction of anaesthesia. Patients in group A were intubated with KVL non channeled blade since this version was available at the study Institute. Patients in Group B were intubated with mcCoy, and those in Group C with macintosh laryngoscope after induction. All intubations were performed by an experienced anaesthesiologist.

All haemodynamic data were measured on arrival in operating theatre, before induction, after induction, and at 1, 2, 3, 5 and 7 minutes after intubation by an independent observer. Preoxygenation with 100% oxygen done and induction with injection fentanyl 2 μg/kg, propofol till the loss of response to verbal commands. After confirming adequate bag-mask ventilation, injection succinylcholine 2 mg/kg was administered. Laryngoscopes were used for intubation depending upon the group.

Primary outcome parameters were CL grade, time from laryngoscopy to successful intubation, number of attempts needed for intubation, any adjuncts or optimisation maneuvers required and any mucosal injury. Secondary outcome parameters were haemodynamic data



[Table/Fig-1]: CONSORT diagram.
Consolidated Standards of Reporting Trials (CONSORT)

(HR, SBP, DBP, MBP) which were measured on arrival, before induction, after induction, and at 1, 2, 3, 5 and 7 minutes after intubation. Successful intubation is defined as correct placement of the Endo Tracheal Tubes (ETT) in the trachea, as confirmed by end-tidal CO_2 capnometry, pulse oximetry and chest auscultation.Time from laryngoscopy to confirmation of successful intubation is defined as time taken from insertion of a laryngoscope till confirmation of ETT placement in trachea by capnometry.

STATISTICAL ANALYSIS

The analysis was done with the use of a Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, version 21.0. The presentation of the categorical variables was done in the form of numbers and percentages (%). Quantitative data with normal distribution were presented as mean±SD and data with non normal distribution as median with 25th and 75th percentiles. Data normality was checked by using the Kolmogorov-Smirnov test. Non parametric tests were used for data not normal. The comparison of the variables which were quantitative and not normally distributed in nature analysed using the Kruskal-Wallis test and a post-hoc analysis by Dunn's multiple pairwise comparison test was carried out. Friedman test followed by pairwise comparison was done to compare haemodynamic parameters within each group at different time intervals. The comparison of the qualitative variables were analysed using the Chi-square test. The p-value ≤0.05 considered statistically significant.

RESULTS

Demographic parameters were comparable in the three groups [Table/Fig-2]. Preoperative mouth opening was two fingers- 53.3% in group A, 50% in group B, 30.33% in group C [Table/Fig-3]. The most frequently observed MPG was 3, 73.33% in group A (3.07±0.52), 83.33% in group B (2.97±0.41), 96.67% in group C (3.03±0.18). Neck mobility and TMD were normal in all patients [Table/Fig-3].

The CL grade obtained was lowest in group B (1.83±0.38) against group A (1.93±0.25), group C (2.13±0.35); p=0.029. Time from laryngoscopy to successful intubation was least in group B (19.5±3.98 seconds) against group A (26.07±9.8 seconds), group C (21.33±3.74 seconds); p=0.002. No significant difference was obtained in the number of attempts, airway adjuncts/optimisation maneuvers, and mucosal injury. No episode of desaturation or abnormal ECG occurred in any of the patients [Table/Fig-4].

HR measured at various time intervals including the preinduction period (p=0.836), postinduction period and at 1 (p=0.07), 2, 3, 5,

Demographic characteristics	A (n=30)	B (n=30)	C (n=30)	p-value
Age (years) (range)	54 (44-63)	47.5 (44-55)	54.5 (52-58)	0.15‡ A vs B:0.301 A vs C:0.361 B vs C:0.051
Female	12 (40%)	8 (26.67%)	9 (30%)	0.516† A vs B:0.273 A vs C:0.417 B vs C:0.774
Male	18 (60%)	22 (73.33%)	21 (70%)	
Weight (kg) (range)	69 (64-70)	70 (65.75-75)	70 (65-74)	0.076‡ A vs B:0.061 A vs C:0.072 B vs C:0.922
Height (cm) (range)	169 (160-171.5)	170 (168.5-176)	170 (161.25-172)	0.067‡ A vs B:0.231 A vs C:0.221 B vs C:0.162
Body mass index (kg/m²) (range)	23.85 (22.6-25.9)	23.75 (22.6-25.85)	25 (23.4-27)	0.285‡ A vs B:0.925 A vs C:0.157 B vs C:0.186

[Table/Fig-2]: Comparison of demographic characteristics between groups A, B, and C.
†Chi-square test, ‡Kruskal-Wallis test
n is the sample size
A=King vision video laryngoscope study group
B=McCoy laryngoscope study group
C=Macintosh laryngoscope study group

Preoperative airway parameters	A (n=30)	B (n=30)	C (n=30)	p-value
Mouth opening (finger)				
1.5	5 (16.67%)	2 (6.67%)	3 (10%)	0.25* A vs B:0.384 A vs C:0.143 B vs C:0.536
2	16 (53.33%)	15 (50%)	10 (33.33%)	
2.5	9 (30%)	13 (43.33%)	17 (56.67%)	
Mallampatti Grade				
2	3 (10%)	3 (10%)	0 (0%)	0.102* A vs B:0.534 A vs C:0.051 B vs C:0.227
3	22 (73.33%)	25 (83.33%)	29 (96.67%)	
4	5 (16.67%)	2 (6.67%)	1 (3.33%)	
Mean±SD§	3.07±0.52	2.97±0.41	3.03±0.18	3.02±0.4
Neck mobility	30 (100%)	30 (100%)	30 (100%)	No p-value
Anatomical abnormality	30 (100%)	30 (100%)	30 (100%)	No p-value
Thyro-Mental distance (centimeters)	6 (6-6)	6 (6-6)	6 (6-6)	0.042† A vs B:0.928 A vs C:0.046 B vs C:0.037

[Table/Fig-3]: Comparison of preoperative airway parameters between groups A, B, and C.
*Fisher's-Exact test, †Kruskal Wallis test
§SD: Standard deviation

7 minutes time intervals after intubation, no significant difference was obtained [Table/Fig-5]. Similarly, for MBP, on intergroup analysis done at the above-mentioned time intervals, no statistically significant difference was found, except at an isolated time interval of 2 minutes for group A vs C [Table/Fig-6]. The p-value at pre-induction was 0.692, at 1 minute postintubation 0.192. Further, on intragroup analysis, a serial attenuation of HR and MBP was observed in all three groups [Table/Fig-5,6]. On pairwise intragroup analysis of haemodynamic parameters at various time intervals of 1 to 7 minutes [Table/Fig-7,8], a uniform pattern of attenuation wasn't seen with any one particular device.

DISCUSSION

In the present study population, mcCoy emerged superior with regards to ease of glottic visualisation and shortest time to successful intubation, as compared to KVVL and macintosh laryngoscope. Haemodynamic response to laryngoscopy was comparable but not significant in the three groups.

Airway parameters postinduction	A (n=30)	B (n=30)	C (n=30)	p-value
CL grade				
1	2 (6.67%)	5 (16.67%)	0	0.029* A vs B:0.334* A vs C:0.122* B vs C:0.012*
2a	11 (36.67%)	13 (43.33%)	9 (30%)	
2b	17 (56.67%)	12 (40%)	16 (53.33%)	
2c	0	0	1 (3.33%)	
3	0	0	4 (13.33%)	
Mean±SD**	1.93±0.25	1.83±0.38	2.13±0.35	1.97±0.35
Number of attempts to successful intubation				
1	21 (70%)	26 (86.67%)	26 (86.67%)	0.163† A vs B:0.209* A vs C:0.209* B vs C:1*
2	9 (30%)	4 (13.33%)	4 (13.33%)	
Any other adjuncts				
Nil	18 (60%)	21 (70%)	19 (63.33%)	0.121* A vs B:0.059* A vs C:0.949† B vs C:0.061*
A	0	2 (6.67%)	0	
B	5 (16.67%)	0	5 (16.67%)	
C	7 (23.33%)	7 (23.33%)	6 (20%)	
Mucosal injury				
Nil	30 (100%)	30 (100%)	30 (100%)	No p value
Time from laryngoscopy to confirmation of successful intubation (seconds)	24 (22-25)	20 (15.75-23.5)	22 (20-25)	0.002‡ A vs B:0.0005 A vs C:0.116 B vs C:0.053
Mean±SD	26.07±9.8	19.5±3.98	21.33±3.74	22.3±6.98

[Table/Fig-4]: Comparison of airway parameters postinduction between groups A, B, and C. *Fischer's-Exact test, †Chi-square test, ‡Kruskal-Wallis test

Intraoperative heart rate (per minute)	A (n=30)	B (n=30)	C (n=30)	p-value
Preinduction	92 (86-98)	90 (84-97.25)	92 (84.75-96)	0.836‡ A vs B:0.581 A vs C:0.636 B vs C:0.937
After induction	90 (87-100)	88 (79.25-98.25)	94 (88.5-98)	0.142‡ A vs B:0.098 A vs C:0.915 B vs C:0.078
1 minute after intubation	100 (95.5-100)	92 (88-100)	95 (88-104)	0.07‡ A vs B:0.051 A vs C:0.271 B vs C:0.228
2 minutes after intubation	96 (90.5-98.75)	91 (86-100)	92 (90-100)	0.219‡ A vs B:0.082 A vs C:0.374 B vs C:0.394
3 minutes after intubation	89 (88-99)	86 (80.5-99)	88 (87-96)	0.138‡ A vs B:0.056 A vs C:0.638 B vs C:0.15
5 minutes after intubation	86 (86-92.5)	84 (78-92.5)	87 (86-88)	0.304‡ A vs B:0.293 A vs C:0.651 B vs C:0.133
7 minutes after intubation	84 (80-86)	82 (77-89)	85 (81-86)	0.696‡ A vs B:0.583 A vs C:0.773 B vs C:0.402
Intragroup p-value	<0.0001	<0.0001	<0.0001	

[Table/Fig-5]: Comparison of intraoperative Heart Rate (HR) (per minute) between groups A, B, and C.
‡Kruskal-Wallis test values in bracket in range

The study achieved glottic visualisation best with mcCoy laryngoscope in patients of group B when compared to KVVL and macintosh [Table/Fig-4]. Contrary to these findings, Ali QE et al., compared channeled KVVL, McCoy and Macintosh laryngoscopes in patients with immobilised cervical spine requiring manual inline stabilisation and, found better glottic visualisation with KVVL [6]. The

Intraoperative mean blood pressure (mmHg)*	A (n=30)	B (n=30)	C (n=30)	p-value
Preinduction	101.5 (88.75-106.75)	102 (93-111.5)	103.5 (97.25-110)	0.692‡ A vs B:0.546 A vs C:0.407 B vs C:0.822
After induction	98 (85.25-105.5)	96 (85-102)	100 (88-103)	0.335‡ A vs B:0.221 A vs C:0.913 B vs C:0.183
1 minute after intubation	111.5 (102-116)	106 (99-112)	107 (100-113.75)	0.192‡ A vs B:0.117 A vs C:0.114 B vs C:0.992
2 minutes after intubation	105 (102.5-107)	105 (100-108)	98 (90.75-98)	<.0001‡ A vs B:0.519 A vs C:<.0001 B vs C:0.0001
3 minutes after intubation	99.5 (87-104)	95 (88-104)	90 (83-98.25)	0.145‡ A vs B:0.882 A vs C:0.077 B vs C:0.105
5 minutes after intubation	91 (86-98)	94 (87-96)	93 (85-97.75)	0.667‡ A vs B:0.37 A vs C:0.697 B vs C:0.611
7 minutes after intubation	86 (80.75-94.75)	88.5 (83-92)	86 (80-94.5)	0.58‡ A vs B:0.405 A vs C:0.899 B vs C:0.337
Intragroup p-value	<0.0001	<0.0001	<0.0001	

[Table/Fig-6]: Comparison of intraoperative Mean Blood Pressure (MBP) (mmHg) between groups A, B, and C.
‡Kruskal-Wallis test
*mmHg=millimeters of mercury values in bracket in range

Intraoperative heart rate (per minute)	Group A	Group B	Group C
Preinduction and after induction	0.984	0.927	0.896
Preinduction and 1 minute after intubation	0.0002	0.126	0.005
Preinduction and 2 minutes after intubation	0.026	0.394	0.190
Preinduction and 3 minutes after intubation	0.981	1.000	0.984
Preinduction and 5 minutes after intubation	0.981	0.712	0.981
Preinduction and 7 minutes after intubation	0.229	0.002	0.010
After induction and 1 minute after intubation	0.006	0.004	0.178
After induction and 2 minutes after intubation	0.216	0.028	0.885
After induction and 3 minutes after intubation	1.000	0.968	1.000
After induction and 5 minutes after intubation	0.654	0.999	0.394
After induction and 7 minutes after intubation	0.028	0.080	<0.0001
1 and 2 minutes after intubation	0.872	0.998	0.885
1 and 3 minutes after intubation	0.006	0.080	0.068
1 and 5 minutes after intubation	<0.0001	0.001	0.0002
1 and 7 minutes after intubation	<0.0001	<0.0001	<0.0001
2 and 3 minutes after intubation	0.229	0.289	0.674
2 and 5 minutes after intubation	0.001	0.006	0.019
2 and 7 minutes after intubation	<0.0001	<0.0001	<0.0001
3 and 5 minutes after intubation	0.634	0.816	0.654
3 and 7 minutes after intubation	0.026	0.004	0.0004
5 and 7 minutes after intubation	0.749	0.229	0.117

[Table/Fig-7]: Comparison of intraoperative Heart Rate (HR) (per minute) between different time intervals in groups A, B, and C using Fried man test followed by pairwise comparison.

use of non channeled KVVL is comparable to the channeled version as per the recent ASA 2022 practice guidelines difficult airway [12].

Likewise, several other studies in the literature have compared glottic visualisation with various video laryngoscopes against direct laryngoscopes [8,10,13,14], and have concluded video laryngoscopes to be superior. These studies had anticipated difficult airway resulting

Intraoperative mean blood pressure (mmHg)	Group A	Group B	Group C
Preinduction and after induction	0.135	0.023	0.216
Preinduction and 1 minute after intubation	0.553	0.166	1.000
Preinduction and 2 minutes after intubation	0.999	1.000	0.009
Preinduction and 3 minutes after intubation	0.614	0.026	<0.0001
Preinduction and 5 minutes after intubation	<0.001	0.018	<0.0001
Preinduction and 7 minutes after intubation	<0.0001	<0.0001	<0.0001
After induction and 1 minute after intubation	0.0003	<0.0001	0.086
After induction and 2 minutes after intubation	0.037	0.016	0.917
After induction and 3 minutes after intubation	0.977	1.000	0.190
After induction and 5 minutes after intubation	0.614	1.000	0.156
After induction and 7 minutes after intubation	0.018	0.243	<0.0001
1 and 2 minutes after intubation	0.845	0.216	0.002
1 and 3 minutes after intubation	0.009	<0.0001	<0.0001
1 and 5 minutes after intubation	<0.0001	<0.0001	<0.0001
1 and 7 minutes after intubation	<0.0001	<0.0001	<0.0001
2 and 3 minutes after intubation	0.306	0.018	0.859
2 and 5 minutes after intubation	<0.0001	0.012	0.816
2 and 7 minutes after intubation	<0.0001	<0.0001	0.007
3 and 5 minutes after intubation	0.135	1.000	1.000
3 and 7 minutes after intubation	0.001	0.229	0.258
5 and 7 minutes after intubation	0.693	0.289	0.306

[Table/Fig-8]: Comparison of intraoperative mean blood pressure (mmHg) between different time intervals in groups A, B, and C using Fried man test followed by pairwise comparison.

from a fixed anatomical cause either simulated or pathologically present. The disparity in the results can likely be explained by the difference in difficult airway scenarios wherein normal cervical mobility was present in all the patients in present study.

From authors clinical experience, an explanation is put forward for the disparity in present study findings with KVVL. It was observed that a longer handle, wider blade increased the difficulty, time of insertion, and manipulation, into the oral cavity to obtain an optimal glottic view. Furthermore, authors clinical experience with KVVL is lesser than with direct laryngoscopes. Difficult airway resulting from infective pathology affecting MPG and mouth opening while maintaining normal neck mobility may have greater ease at glottic visualisation with mcCoy laryngoscope.

Present study observed that time from laryngoscopy to successful intubation was significantly shorter with mcCoy laryngoscope when compared with KVVL and macintosh [Table/Fig-4]. Concordantly, time from glottic visualisation to intubation was observed to be longer with KVVL by Erdivanli B et al., when comparing it with macintosh in normal airways [15]. Conversely, shorter time to intubation was observed with KVVL when compared to macintosh in studies by Murphy LD et al., and Aleksandrowicz D et al., [7,9].

Arshad Z et al., found mcCoy to have a significantly lower time to successful intubation against macintosh laryngoscope in the anticipated difficult as opposed to in normal airways [16]. Similarly, the mcCoy group had the shortest time to successful intubation in present study subjects having anticipated difficult airway.

Nandakumar KP et al., concluded that glidescope took a longer time to intubate with no significant difference in CL grade against macintosh and mcCoy in morbidly obese patients [17]. They ascribed it to the need for hand-eye coordination with video laryngoscopes and difficult negotiation of ETT due to its impingement on arytenoids despite better glottic visualisation. Authors experienced the same with KVVL. Furthermore, reduced space may be available for introducing ETT during laryngoscopy due to central tongue position, which may be amplified by the presence of a large tongue and, or airway oedema.

It is noteworthy that the patients in the present study had physiologically difficult airways, in addition, owing to the underlying co-morbidities causing physiologic derangements, compromising the oxygen reserve, and increased risk of cardiovascular collapse during airway management. Hence, safe apnoea time was a limiting factor in this subset, making time from laryngoscopy to successful intubation an important consideration.

Contrasting observations have been made in the current literature pertaining to the time from laryngoscopy to intubation, with no laryngoscope unanimously established as superior over others. The intubation device performance varies with the airway scenario and expertise of the user. Present study concluded that mcCoy laryngoscope had the shortest time to intubation in the subset of difficult airway patients affected by mucormycosis.

Pieters BMA et al., in a meta-analysis, concluded that video-laryngoscopes had better glottic visualisation compared with macintosh in difficult airways, but time to successful intubation was more, akin to our observation [18]. In a study by Pieters BM et al., various video laryngoscopes were compared with macintosh in manikins by experienced anaesthetists, residents, and paramedics and it was concluded, that, no single device was best for all caregivers [19].

Different studies have used simulated immobilised cervical spine as the benchmark where oral, pharyngeal, and laryngeal axes alignment was required without neck motion [6-10,13-15], whereas neck mobility was intact in present study participants who had restricted mouth opening and MPG 3 as the cause of anticipated difficult airway. Therefore, the present study was not comparable to those in the above-referenced studies, thereby possibly resulting in disparate observations.

In present study, on intergroup comparative analysis of the intra-operative HR and MBP, no statistically significant difference was found; further on intragroup analysis [Table/Fig-5,6], HR, MBP were serially attenuated from 1 to 7 minutes post-intubation in all. Although a uniform attenuation pattern was not observed with any one particular device. Thus, present study did not establish any particular device significant for response attenuation to laryngoscopy, though the haemodynamic parameters were uniformly preserved in all.

The literature has contrasting evidence on attenuation of pressor response with video laryngoscopes when compared to direct laryngoscopes. Aggarwal H et al., in normal airways observed mcCoy laryngoscope to have a better haemodynamic response against C-mac and macintosh, being attributed to shorter laryngoscopy time and more experience with mcCoy, despite better glottic visualisation with C-mac [20]. This neutralised the benefit of decreased airway tissue distortion on the pressor response by video laryngoscopes. Conversely, Devi NA et al., found KVVL to have a favorable haemodynamic response over macintosh [21].

Arshad Z et al., studied haemodynamic response in anticipated difficult and normal airways in ASA I, II patients. HR increase with laryngoscopy was significantly more with macintosh in the predicted difficult airway but more with mcCoy in the easy airway. MBP response to laryngoscopy with the two laryngoscopes was comparable in both the airway scenarios [16]. In present study, HR, MBP responses were better with mcCoy though not statistically significant.

Nandakumar KP et al., comparing macintosh, mcCoy, and glidescope in morbidly obese found comparable haemodynamic response similar to present study [17]. Buhari FS and Selvaraj V found increased pressor response with C-mac in comparison with mcCoy and macintosh where it was similar, amongst ASA I patients with normal airways [22]. Han TS et al., and Haidry MA and Khan FA observed better attenuation of pressor response with mcCoy over macintosh in normal airways [23,24]. This was explained by the basic design of mcCoy blade requiring less lifting force during laryngoscopy, thus generating a less pressor response.

However, in present study patients mostly had anticipated difficult airways with co-morbidities. Additionally, difficult bag and mask ventilation with higher MPG grades may have resulted in an inadequate depth of anaesthesia during laryngoscopy, though this was not studied. The difference in anaesthetic depths may have resulted in the variable pressor response to laryngoscopy. Although, such patients were in comparable numbers in the three groups. In forgoing studies [20-24], the anticipated difficult airway was exclusion criterion which could have resulted in discordant observations.

Video laryngoscopes usually seen to have an edge over other laryngoscopes when primarily studied for attenuation of pressor response in patients having normal airways. While, in difficult airway scenarios including present study, an advantage in pressor response has not been shown with any particular laryngoscope.

Literature has diverse conclusions on the superiority of video laryngoscopes over direct laryngoscopes in different airway scenarios namely anticipated, unanticipated, and genuinely difficult airways. It is not easy to identify genuinely difficult airways as the diagnostic tests have low sensitivity and positive predictive value [23]. In present study population, MPG was found to be the single major parameter anticipating difficult airways. It has poor inter-observer reliability and positive predictive value when used alone [24].

Video laryngoscopes are a far-reaching augmentation of the difficult airway cart. Proficiency with video laryngoscopes comes with a learning curve [25]. Familiarity with direct laryngoscopes might unintentionally make the anaesthetists try to align oral, pharyngeal, and tracheal axes [26], paradoxically hindering intubation. The benefits of new devices might be outweighed by a lack of familiarity with them. The maximum benefit attained from any device needs to be assessed with its limitations and matched with the level and type of difficulty. Present study observed the ease of glottic visualisation and least duration to successful intubation using mcCoy laryngoscope in airways affected by mucormycosis.

Limitation(s)

Present study dealt with a small subset of patients, from a single centre, using only non channeled KVVL which may not have been the most appropriate choice of video laryngoscope. Furthermore, some study patients did not have an anticipated difficult airway.

CONCLUSION(S)

McCoy laryngoscope was found to perform better with regards to ease of glottic visualisation and shortest time to intubation. The haemodynamic response was comparable with that of KVVL and macintosh laryngoscopes in patients of ROCM scheduled for debridement procedures. Further research is warranted in comparing the whole spectrum of video laryngoscopes with macintosh and mcCoy laryngoscopes to decide the best device for the patient while taking into account the patient's airway and the expertise of the user.

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