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Original Article

Intraocular Pressure Changes Following Laryngoscopy and Tracheal Inubation with Macintosh Laryngoscope and Videolaryngoscope (King Vision) In Non-Ophthalmic Surgeries: A Randomized Study

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ABSTRACT

Background and Aims: Laryngoscopy for tracheal intubation produces a hemodynamic stress response like changes in heart rate and blood pressure, intracranial pressure, intra ocular pressure (IOP). Many pharmacological and non-pharmacological methods have been employed to limit these pressor responses. We hypothesize that as lower lifting forces are required to visualize the glottis while using videolaryngoscopes, hence they should have a beneficial influence on hemodynamics and in turn IOP.

Methods: After taking written and informed consent, the patients were allocated by computer generated randomization in 2 groups of 40 patients each.

Grp VL- patients were intubated using Kings Vision videolaryngoscope Grp DL – patients were intubated using Macintosh laryngoscope.

Heart rate, blood pressure and IOP were recorded just before laryngoscopy,(either by Macintosh or Kings Vision videolaryngoscope) and 1 , 3 and 5 minutes after intubation, by independent anaesthesiologists

Results: There was a significant difference in IOP, both in left and right eye from the baseline in direct laryngoscopy group at 1 3 and 5 minutes. No significant difference in IOP from baseline levels was noted in videolaryngoscopy (VL) group .In fact a decrease in IOP was noted at 5 min in VL group in the left eye and no significant change happened in IOP of right eye anytime that we measured (1,3 and 5 min) post intubation.

Conclusion: With the use of KVVL, lesser hemodynamic changes and lesser variations in IOP were noted, so the above can be better than DL for use in surgeries where sudden increase in IOP can be deleterious.

Key Words: *Intraocular pressure, video laryngoscope, King Vision, Mcintosh, hemodynamic*

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INTRODUCTION

Laryngoscopy for tracheal intubation has been known to produce a hemodynamic stress response like changes in heart rate and blood pressure, intracranial pressure, intra ocular pressure (IOP) etc [1, 2]. This has been further confirmed by the rise inplasma nor adrenaline levels, hence increased sympathetic activity [3].

Though brief stress response is tolerated well with no long term complications in healthy individuals, it can have deleterious effects on patients with uncompensatedsympathetic responses like in hypertension, myocardial insufficiency and cerebrovascular disease. Rise in IOP can be a reliable indicator of this stress response [4].

Many pharmacological and non-pharmacological methods have been employed to limit these pressor responses. Premedication with various drugs have been studied extensively for the same. Simultaneously use of airway establishing methods have been studied. For example use of supraglottic devices like laryngeal mask airway (conventional, proseal, intubating) have been compared for its effect on IOP [5, 6]. Video laryngoscope functions independently of the line of sight, reduces upward lifting forces to expose the glottis and requires less cervical neck movement for intubation.

Videolaryngoscopy has been a part of AIDAA algorithm for unanticipated difficultairway for its use in first attempt alongside direct laryngoscopy. There is also a significant increase in the percentage of glottic opening visibility when using the video laryngoscope with cervical spine immobilization [8, 9].

Practically it has gained widespread popularity during the COVID pandemic [7]. Conventional laryngoscopy has been compared to video laryngoscopy as well for its effect on IOP. Even the different video laryngoscopes have been compared for IOP changes associated with intubation via them.

We in this study compared the hemodynamics and pressor response in patients intubated using Macintosh direct laryngoscope and Kings Vision video laryngoscope. We hypothesize that as lower lifting forces are required to visualize the glottis while using videolaryngoscopes, hence they should have a beneficial influence on hemodynamics and in turn IOP. To the best of our knowledge no study has as of now been done to compare the pressor response by use of Macintosh direct laryngoscopy and Kings vision video laryngoscopy in non-ophthalmic procedures.

MATERIALS AND METHODS

This prospective randomized study was conducted in the operating room of Hamdard Institute of Medical Sciences & HAHC Hospital after institutional ethical committee approval .The CTRI registration number of the trial is CTRI/2020/10/028415.

Eighty patients who were ASA grade 1, either sex, 18 - 65 years of age, scheduled for any non-ophthalmic surgery under general anaesthesia and requiring endotracheal intubation were included in this study. Patients of ASA grade 2 or more, patients with any preexisting raised IOP, anticipated difficult airway and history of relevant drug allergy was excluded from the study. In cases where laryngoscopy time exceeded 20 seconds, those patients were also excluded.

After taking written and informed consent, the patients were allocated by computer generated randomization in two groups of forty patients each.

Grp VL- patients were intubated using Kings Vision videolaryngoscope Grp DL – patients were intubated using Macintosh laryngoscope.

Intraoperative monitoring included electrocardiograph, heart rate oxygen saturation s(sPo2), end tidal carbon dioxide and non invasive blood pressure, through a multi- channel cardiac monitor. Baseline vitals were recorded. The intraocular pressure of both eyes was recorded by an experienced ophthalmologist with the help of Schiotz tonometer. General anaestheia was induced with the predefined protocol. Injection Fentanyl 2ug/kg IV was used for premedication. Induction was done by Injection propofol 2 mg/kg IV and Injection Vecuronium 0.1 mg/kg IV. Laryngoscopies, both direct and video assisted was performed by the experienced anaesthesiologists. Heart rate, blood pressure and IOP were recorded just before laryngoscopy, (either by Macintosh or Kings Vision video laryngoscope) and 1, 3 and 5 minutes after intubation, by independent anaesthesiologists.

Statistical evaluation

The data has been presented as mean ± SD. Student's t-test was used to compare demographic data and intra-ocular pressure and haemodynamic parameters at each point of time. The trends of heart rate, blood pressure and IOP within the group were analysed using two-way analysis of variance with post-hoc analysis. Postoperative adverse effects were compared using the chi square test. P
<0.05 was considered significant.

RESULTS

The patients characteristics showed no difference between the two groups (Table 1)

Table 1: Patients Characteristics

	DL	VL	P-value
Age (in years)	36.08± 11.08	37.83 ±10.74	0.476*
Sex			
Male	18(45.0)	20(50.0)	0.654**
Female	22(55.0)	20(50.0)	
Weight (in Kgs)	57.3±7.7	58.35±8.5	0.565*
Height	155.95±4.63	156.12±4.64	0.867*
BMI (Kgs/m$^{2)}$	23.53±2.86	23.89±2.99	0.589*

*Independent t-test, **Chi-square test

All vitals parameters, heart rate , pulse oximetry, systolic(SBP), diastolic(DBP) and mean arterial pressure(MAP) were recorded before induction, after induction but before intubation, after intubation at 1, 3 and 5 minutes. There was no significant difference found in heart rate and oxygen saturation between the two groups. The intergroup comparison of SBP, DBP and MAP showed a significant difference at 3 mins after intubation in the DL and VL groups (p value 0.01, 0.003 and 0.001 respectively at 1, 3 and 5 min).

Table 2: Changes in physiological parameters

PhysiologicalParameters	**DL**	**VL**	**P-value***
Systolic Blood Pressure			
BI	131.50±13.741	131.03±14.165	0.879
PI	121.58±18.31	122.25±17.95	0.868
1min	122.90±18.37	125.83 14.97	0.437
3min	121.05±13.12	113.13 ±13.64	**0.01****
5min	113.50 ±13.90	112.93±14.83	0.859
Diastolic Blood Pressure (in mm Hg)			
BI	76.20± 8.34	74.13 ±8.13	0.263
PI	71.18± 11.56	72.73 ±12.34	0.554
1min	75.68 ±10.61	74.98 ±10.35	0.766
3min	74.83± 10.26	67.63 ±10.30	**0.003****
5min	68.78 ±10.0	68.03 ±9.43	0.731
MAP (in mm Hg)			
BI	93.75± 8.71	92.13± 8.54	0.402
PI	87.68± 11.98	88.30 ±13.14	0.825
1min	90.90 ±10.35	90.78 ±10.34	0.957
3min	88.95 ±8.36	81.93 ±10.13	**0.001****
5min	82.85 ±9.2	82.25 ±9.9	0.781
Pulse Rate (per minute)			
BI	86.65 ±15.52	85.23± 13.47	0.662
PI	79.98 ±11.06	80.63 ±10.60	0.789
1min	85.35 ±11.65	84.65 ±9.69	0.771
3min	77.43 ±9.95	80.33 ±7.08	0.137
5min	73.3 ±14.34	76.93 ±6.97	0.155
SPO2 (%)			
BI	99.93± 0.27	99.93± 0.27	1.0
PI	99.80 ±0.52	99.75± 0.63	0.699
1min	99.75± 0.53	99.93± 0.27	0.07
3min	99.90 ±0.30	99.93± 0.27	0.697
5min	99.85 ±0.36	99.88± 0.34	0.747

***Independent t-test, ** statistically significant**

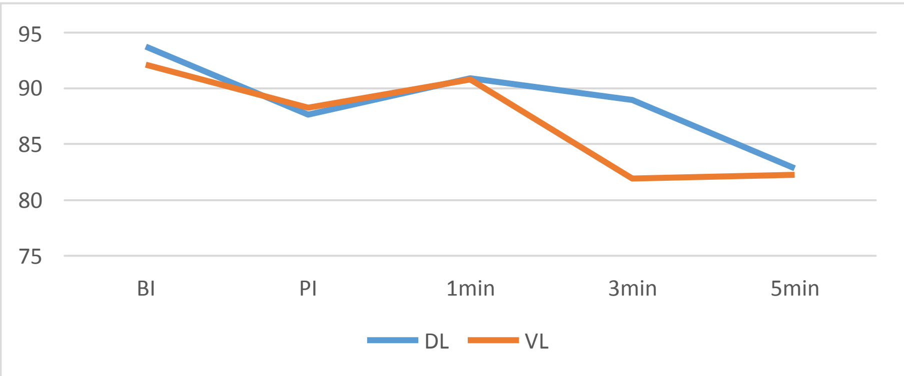


Figure 1: Changes in MAP in two groups

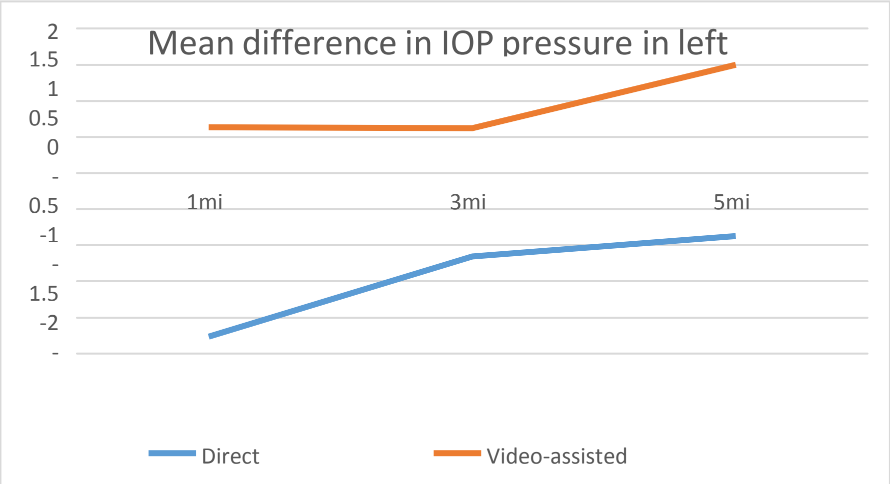
Intergroup analysis of difference of left eye IOP from baseline at 1, 3 and 5 minutes post intubation was significantly higher in the DL group compared to VL group with p values 0.00. 0.004 and 0.00 respectively. In addition, intragroup analysis of left eye IOP showed significant increase in value from baseline (before intubation) and at 1 and 3 mins after intubation in DL group (p value 0.00 and 0.016). Whereas in the VL group a significant decrease in IOP was observed at 5 mins post intubation compared to baseline (p value 0.00). No significant increase in IOP was observed at 1 and 3 minutes in VL group.

Table 3: Changes in Intraocular Pressure
***Independent t-test, ** statistically significant**

Intergroup analysis of difference in IOP measures at 1 min, 3 min and 5 min frombaseline values (Pi) – Left Eye

Group Statistics

	DL_VL	N	Mean	Std. Deviation	Std. Error Mean	P value
LeftBL-1min	1.0	40	-2.2650	3.41194	.53947	0.000
	2.0	40	.6325	2.58758	.40913	
LeftBL-3min	1.0	40	-1.1575	2.89623	.45793	0.004
	2.0	40	.6200	2.37748	.37591	
LeftBL-5min	1.0	40	-.8725	2.82607	.44684	0.000
	2.0	40	1.4975	2.38602	.37726	

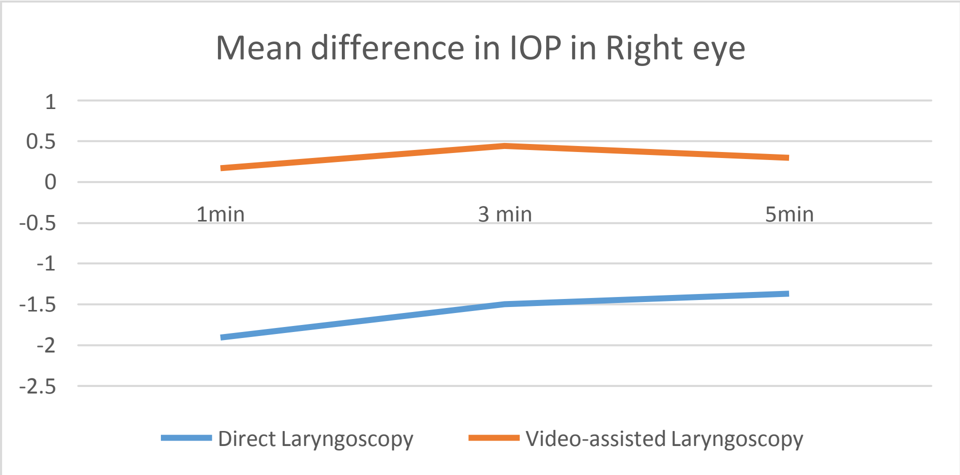


Intergroup analysis of difference of right eye IOP from baseline at 1, 3 and 5 mins postintubation was significantly higher in the DL group compared to VL group with p values 0.00. 0.001 and 0.004 respectively. Intragroup analysis of right eye IOP showed significant increase in value from baseline (before intubation) and at 1 3 and 5mins after intubation in DL group (p value 0.00, 0.002 and 0.003). Whereas in the VL group no significant change in IOP was observed post intubation compared to baseline.

Intergroup analysis of difference in IOP measures at 1 min, 3 min and 5 min frombaseline values (Pi) - Right eye

Group Statistics

	DL_VL	N	Mean	Std. Deviation	Std. Error Mean	P value
RightBL-1min	1.0	40	-1.9075	2.35757	.37276	0.000
	2.0	40	.1700	1.83068	.28946	
RightBL-3min	1.0	40	-1.5025	2.88155	.45561	0.001
	2.0	40	.4425	2.09614	.33143	
RightBL-5min	1.0	40	-1.3700	2.69284	.42578	0.004
	2.0	40	.3000	2.32875	.36821	



DL Left and Right Intragroup analysis

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean	P value
Pair 1	AIOPleftpi	12.3400	40	2.68527	.42458	.000
	AIOPLeft1min	14.6050	40	2.31992	.36681	
Pair 2	AIOPleftpi	12.3400	40	2.68527	.42458	.016
	AIOPleft3min	13.4975	40	1.58024	.24986	
Pair 3	AIOPleftpi	12.3400	40	2.68527	.42458	0.58
	AIOPleft5min	13.2125	40	2.12858	.33656	
Pair 4	AIOPrightPi	12.0850	40	2.21412	.35008	.000
	AIOPright1min	13.9925	40	2.38278	.37675	
Pair 5	AIOPrightPi	12.0850	40	2.21412	.35008	.002
	AIOPright3min	13.5875	40	2.44385	.38641	
Pair 6	AIOPrightPi	12.0850	40	2.21412	.35008	.003
	AIOPright5min	13.4550	40	2.22399	.35164	

VL Left and Right eyeIntragroup analysis

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean	P value
Pair1	AIOPleftpi	14.0975	40	2.63093	.41599	.130
	AIOPLeft1min	13.4650	40	2.01056	.31790	
Pair2	AIOPleftpi	14.0975	40	2.63093	.41599	.107
	AIOPleft3min	13.4775	40	1.43160	.22636	
Pair3	AIOPleftpi	14.0975	40	2.63093	.41599	.000
	AIOPleft5min	12.6000	40	1.75412	.27735	
Pair4	AIOPrightPi	14.3375	40	1.52999	.24191	.560
	AIOPright1min	14.1675	40	1.69227	.26757	
Pair5	AIOPrightPi	14.3375	40	1.52999	.24191	.190
	AIOPright3min	13.8950	40	1.38988	.21976	
Pair6	AIOPrightPi	14.3375	40	1.52999	.24191	.420
	AIOPright5min	14.0375	40	1.68092	.26578	

DISCUSSION

There was a significant difference in IOP, both in left and right eye from the baselinein direct laryngoscopy group at 1 3 and 5 minutes. No significant difference in IOP from baseline levels was noted in videolaryngoscopy (VL) group .In fact a decrease in IOP was noted at 5 min in VL group in the left eye and no significant change happened in IOP of right eye anytime that we measured (1, 3 and 5 min) post intubation. Systolic blood pressure, diastolic blood pressure and Mean arterial pressure were the significant predictors that corelated with the changes in IOP. There was a significant increase in all at 3 minutes in VL group.

Various studies associate the tracheal intubation with the rise in IOP [10, 11]. These were probably due to the changes in ocular blood flow and alterations in arterial blood pressure and due to increase in central venous pressure during tracheal intubation dueto vasoconstriction [12].

The resistance to the outflow of aqueous humor between anterior chamber and canal of Schlemm can also contribute to the sudden rise in IOP during tracheal intubation. Various studies have compared conventional laryngoscopy to videolaryngoscopy in terms of the stress response, various videolaryngoscopes have also been compared among themselves for the same. But to the best of our knowledge no study has previously compared the conventional Mcintosh larygoscopy and King s Visionlaryngoscopy.

Malik et al [13] and Xue et al [14] almost had similar reports that the Macintosh, Tru- view EVO2, Glide Scope, and Airwayscope had no advantages on attenuating hemodynamic responses to intubation and the Glide Scope video laryngoscope and theMacintosh laryngoscope caused similar hemodynamic changes to intubation respectively. Jeon et al [15] supported the above two by reporting no difference in the hemodynamic parameters during intubation with the McGrath Series 5 and the GlideScope video laryngoscope.The present study showed that the MAP values in DL group had significant difference post intubation while in VL group showed no such difference. This is in slight variance to the above studies.

On comparing Mccoy and Macintosh blades lesser stress response was reported in the former by McCoy et al [16] and Singhal et al [17]. This was probably due to lower lifting force required by the Mccoy blade. Russell etal [18] conclusively measured the lifting forces required by Video and Mcintosh laryngoscopes and reported it to be less with videolaryngoscopes.

A few studies which compared the Kings Vision and Macintosh laryngoscope postulated that KVVL offers faster intubating conditions for tracheal intubation requiring armored ETTs in comparison to DL using Macintosh blade but requireslonger times to visualize the glottis and to intubate the trachea, but does not causeadditional desaturation [19].

With regards to the above mentioned studies, the present study showed that the changes in MAP, SBP and DBP varied proportionately with the changes in IOP fromthe baseline, showing statistically significant increase of MAP at 3 minutes in DL group. The changes in IOP from baseline in both left and right eye were more in DL group. VL showed statistically non significant changes.

The above findings can be due to the assumption that Kings vision probably requires a lesser lifting force and hence lesser release of catecholamines, hence decreased sympathetic activity and less rise or in fact stable IOP.

CONCLUSION

Hence the conclusion of the study was that with the use of KVVL, lesser hemodynamic changes and lesser variations in IOP were noted, so the above can be better than DL for use in surgeries where sudden increase in IOP can be deleterious.

Limitation

One limitation of the study is that as ASA 1 patients were only included, the mean ageof the study groups was under 40, which is less than the patients usually encountered for ophthalmic surgeries. Also the patients with altered stress response like hypertensives were excluded from the study,so there response to KVVL cant be definitely made out.

Further studies are needed in higher ASA grade patients with catecholamine measurements during laryngoscopy to definitely establish the use of KVVL overMcintosh DL.

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