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Research Article

Comparison of Hemodynamic and Intraocular Pressure Response between Two Techniques of Securing Airway.

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Abstract: Background and Aim: Achieving minimal hemodynamic variation and IOP changes during intubation is one of the main concerns of anesthetists in certain cases. Hence our study is aimed to know which technique of securing airway is preferred in order to have minimal hemodynamic and IOP response. **Method:** A randomized control study was performed on 60 patients who were divided into 2 groups with 30 in each group. One group patients had Ambu laryngeal mask airway insertion whereas the other group was intubated with endotracheal tube. The hemodynamics and IOP of each patients were measured after induction of anesthesia which was taken as baseline, then noted at 1, 2, 3minutes. The mean of the response variables were calculated and compared between the two groups. **Results:** The hemodynamic response in the endotracheal intubation group was significantly higher as compared to the LMA group. But the IOP responses were not significantly high in endotracheal intubation group when compared with the LMA group. **Conclusion:** Endotracheal intubation can be stressful to the heart than LMA insertion but its effect on intraocular pressure is minimal and comparable to that of laryngeal mask airway.

Keywords: Hemodynamic response, intraocular pressure, endotracheal intubation, Laryngeal Mask Airway.

INTRODUCTION:

The most common method of securing the airway during anesthesia is through laryngoscopy and endotracheal intubation. But it is associated with the change in plasma catecholamine concentration (Ghai , B. *et al.*, 2001). Now days LMA is one of the most commonly used device to secure airway both in elective cases and in emergency difficult airway situations. LMA insertion is much easier, less manipulative and does not require visualization of the cords. Hence it may provoke less sympathetic response and catecholamine release (McGoldrick, K. E. 1992). There is a broad correlation between mean arterial pressure and catecholamine concentration in blood (McGoldrick, K.E. & Gayer, S.I. 2006). The rise in IOP may be less as compared to that of endotracheal intubation. In elective and adequately fasted patients, LMA may be an ideal choice where hemodynamic and IOP responses are of prime importance.

This transient hemodynamic response has not many consequences in healthy patients. But in patients with compramised cardiovascular system or with history of cerebral vascular accidents (CVA) or with aneurysm this transient response can be disastrous. Such people can tolerate high hemodynamic responses only if it lasts for short period of time. Certainly the impact of these cardiovascular responses will become more profound when they are sustained for a long duration of time, particularly for patients with a severely compromised myocardial function or intravascular depletion (Shribman, A.J. *et al.*, 1987).

Hemodynamic responses usually correlates with intraocular pressure (IOP) changes, due to increased blood flow to choroidal vessels. This transient increase in IOP usually does not cause any significant problems. But in patients with glaucoma or open eye injury this increase in IOP can cause changes in disc perfusion and cause it to reach a critical point beyond which it can lead to disc ischemia.

Thus in our study we are looking at the hemodynamic and IOP response in both the groups to know which technique is better to have a stable hemodynamics and intraocular pressures.

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REVIEW OF LITERATURE:

In the 18th century, endotracheal intubation was used during resuscitation from drowning, but these tubes were passed without direct visualization and were not for the delivery of anesthetic agents. Sir William Macewen was the first physician to intubate the trachea orally for the sole purpose of administering anesthesia. Robert R.Macintosh's improved laryngoscope featured a short, curved blade that elevated, instead of retracting the epiglottis, a considerable improvement over previous laryngoscopes[1].

In the year 1983 Dr. Archie Brain described a new type of airway, which may be used as an alternative to the endotracheal tube. This was Laryngeal Mask Airway (LMA). It was introduced into clinical practice in 1988. Since its introduction it has undergone many modifications and addition of various new models (Brain, A.I.J. 1983). One among such modifications includes ambu LMA which is used in our study. It is a disposable device that has a cuff that is tapered at the tube. It has no aperture bars. The inflation line is attached to the airway tube. It has a reinforced tip. The airway tube is larger and more rigid and is precurved (Dorsch, J. A., & Dorsch, S. E. 1994). Hence insertion does not require a lot of manipulation.

Maximum manupulation occurs during larygoscopy. Irritation of the supraglottic tissue causes catecholamine release and leads to highest hemodynamic response. Intubation with the tube also causes irritation but is negligible as compared to laryngoscopy. The catecholamine release following laryngoscopy with or without intubation was similar hence suggesting lack of contribution by endotracheal tube insertion for pressure response (Shribman, A.J. *et al.,* 1987). By activating proprioceptors, direct laryngoscopy induces arterial hypertension, tachycardia, and increased catecholamine concentration proportional to the intensity of the stimulus exerted against the base of the tongue. However, subsequent tracheal intubation should stimulate additional receptors in the larynx and the trachea, thus enhancing the hemodynamic and epinephrine response (Deem, S.A. *et al.,* 2007). Hence it is ideal to perform larygoscopy and intubate within 15sec to obtain minimal response and better to avoid multiple attempts.

Stable intraocular pressure is very much important during ophthalmic surgeries. Hence choosing right type of anesthetics is important during intra ocular surgery. The mechanism of IOP rise is secondary to increased sympathetic activity. Adrenergic stimulation causes vaso and venoconstriction and an increase in central venous pressure, which has a close relationship with IOP. In addition adrenergic stimulation can also produce an acute increase in IOP, by increasing the resistance to the outflow of aqueous humor in trabecular meshwork between anterior chamber and Schlemn's canal (Ghai , B. *et al.,* 2001).

Two thirds of aqueous humor is formed in posterior chamber by ciliary body in an active secretory process. At ciliary epithelium, sodium is actively transported into aqueous humor in posterior chamber. Bicarbonate and chloride ions follow sodium ions passively. Aqueous humor flows from posterior chamber through papillary aperture and into anterior chamber where it mixes with aqueous humor formed by iris (McGoldrick, K. E. 1992).

Aqueous humor flows from anterior chamber to the periphery where it exits through the trabecular network. Then it enters the Schelmn's canal and then through the episcleral venous plexus which through the venous plexus lead to the superior vena cava and finally the right atrium (McGoldrick, K. E. 1992).

IOP varies normally between 10 to 21.7mmHg. During anesthesia, a rise in IOP can trigger acute glaucoma. If penetration occurs with high pressure, there can be rupture of blood vessel and subsequent haemorrhage may occur (McGoldrick, K.E. & Gayer, S.I. 2006).

If the venous return from the eye is disturbed at any point from the Schlemm's canal to the right atrium, IOP increases substantially. This is caused by both an increased intraocular blood volume, as well as by interference with aqueous outflow. Laryngoscopy and tracheal intubation may elevate IOP. Topical anesthesia may attenuate hemodynamic changes but not IOP.

If coughing or straining occur when the eye is open, as in keratoplasty, the result may be disastrous expulsive haemorrhage or can be only disconcerting vitreous loss.

Tracheal intubation has universally been thought to be associated with pressor response and increase in IOP which is deleterious in perforating eye injuries and patients with glaucoma. Apart from providing an immobile and uncongested field, attempts were made to decrease the intraocular pressure during ophthalmic surgery. Because of improved anaesthetic agents,equipment's and techniques, the anaesthesiologist could optimize the condition during surgery.

PATIENTS AND METHODOLOGY:

A total of 60 patients belonging to American Society of Anesthesiologist (ASA) physical status 1 or 2 between age groups of 20 to 60 years were included in the study. Informed and written consent was obtained from each patient. Each patient underwent a preoperative evaluation and advised nil per oral for 6 hours.

Each patient was allocated in one of the 2 groups.

- Group 1 - Ambu laryngeal mask airway was used.
- Group 2 - Endotracheal intubation was done.

Exclusion Criteria:

- Patients with a known cardiovascular or respiratory disease.
- Known diabetic or hypertensive patient.
- Need for use of rapid sequence intubation technique.
- Patients who are known to have glaucoma or suspected to have the same on history.
- Contraindication to LMA.
- Patients with suspected difficult airway or detected to have difficult airway during intubation.
- Patients with ophthalmic infection.
- Patients with previous ophthalmic surgeries.
- Intubation or placement of LMA requiring more than 20 seconds.
- Patients unwilling to give consent.

On day of surgery patient was shifted to OT and IV access secured. Base line heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure with patients in supine position. Injection fentanyl 2mcg/kg IV was given. Preoxygenation was followed by induction with Thiopentone in titrated dose and muscle relaxation with vecuronium (0.1mg/kg). Using oxygen and isoflurane 1% mask ventilation was carried out by a single anesthesiologist using appropriate face mask for 3min.

3min later readings of heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure and intraocular pressure were taken using Schiotz tonometer. Depending on the group allocated to the patient, either ambu LMA insertion was performed (GROUP 1) or endotracheal tube was inserted (GROUP 2). If there was more than one attempt or the time exceeded 20seconds the case was excluded from study.

Heart rate, systolic BP, diastolic BP, mean BP and IOP readings were taken at 1min, 2 min, 3 min after either tracheal intubation or LMA insertion.

After the third reading antibiotic eye ointment ciprofloxacin was put. Surgery was allowed to start after 3 min of intubation or LMA insertion. Anesthesia was maintained with oxygen, nitrous oxide and isoflurane with intermittent dose of vecuronium and opioid supplementation as and when necessary. At the end of surgery neuromuscular blockade reversed with neostigmine (0.05mg/kg) and glycopyrrolate (0.01mg/kg). When the patient was fully awake trachea was extubated or LMA was removed whichever the case may be.

RESULTS:

STATISTICAL ANALYSIS:

The statistical analysis was done using IBM SPSS STATISTICS 20 software. The graphs were drawn using Microsoft excel 2013 software.

The comparison of the hemodynamic variables and intraocular pressures between group 1 and group 2 was done and p-value was calculated using independent T-test.

The demographic data were comparable between two groups. The details are in the following table:-

Table.1

Groups	AGE (years±SD)	SEX (Number)	
		Male	Female
Group 1	38.70±10.59	16	14
Group 2	37.33±12.85	17	13
p- value	0.6	0.5	

Baseline Hemodynamics:

After induction with thiopentone , muscle relaxant vecuronium was given and patient was mask ventilated for 3min. Just prior to airway manipulation hemodynamics and IOP were measured. These values were kept as baseline and were compared between the two groups to check for any significant difference.

Table.2

	Heart rate (beats/min)			**IOP (Right) (mmHg)**			**IOP (Left) (mmHg)**		
	Group 1	**Group2**	**p- value**	**Group1**	**Group 2**	**p-value**	**Group1**	**Group2**	**p-value**
pre-manupulation	74.40±9.77	74.03±12.29	0.899	9.29±2.63	8.46±2.88	0.248	9.29±2.63	8.46±2.88	0.248
1 minute	82.43±10.43	92.10±11.61	0.001	12.41±3.51	11.16±3.84	0.19	12.41±3.51	11.16±3.84	0.19
2 minute	79.76±10.45	88.66±10.65	0.002	10.89±3.28	1.20±3.09	0.40	10.89±3.28	1.20±3.09	0.40
3minute	76.73±9.41	84.33±11.40	0.007	9.91± 2.80	9.06± 3.11	0.27	9.91± 2.80	9.06± 3.11	0.27

*SD = standard deviation , IOP = intraocular pressure , mmHg= milimeter mercury

Table.3

	Systolic BP (mmHg)			**Diastolic BP (mmHg)**			**Mean BP (mmHg)**		
	Group 1	Group 2	p-value	Group 1	Group 2	p-value	Group 1	Group 2	p-value
Pre-manipulation	98.93±15.81	97.36±16.70	0.71	56.76±13.73	55.10±13.30	0.635	71.13±13.49	70.00±13.52	0.746
1minute	109.66±17.89	126.93±21.26	0.001	63.03±13.78	75.66±13.47	0.001	78.90±14.60	92.80±14.44	0.000
2minute	105.30±14.61	122.73±18.96	0.000	60.06±12.10	72.50±12.09	0.000	74.26±13.22	89.63±13.68	0.000
3minute	102.50±13.60	114.83±17.89	0.004	58.90±9.70	68.40±12.34	0.002	73.60±9.80	85.43±12.48	0.000

* BP= blood pressure , mmHg = milimeter mercury

The above table gives the details of mean value of hemodynamic and IOP response before manupulation and at 1,2,3 minutes after manupulation of group 1 and group 2. It also shows the p-value obtained by comparing the value of the two groups using SPSS statistics software.

DISCUSSION:

All the demographic data were comparable to eachother in our study. All the baseline values were checked after induction and before manupulation. They were comparable to eachother also. Required study data were noted at 1,2 and 3 minutes interval and were compared between two groups.

Superficial analysis of our study looked like the hemodynamic and IOP reponse in group 2 was higher than group 1. endotracheal intubation created a higher hemodynamic and IOP response in patients than LMA. But when values were analysed statistically we concluded with a report as hemodynamic response in group 2 was significantly higher as compared to group 1 whereas IOP response was not significantly high. IOP response of patients with LMA insertion were comparable to the IOP of intubated patients.

Eventhough the IOP response usually correlate with the hemodynamic response, in our study we found that IOP response was not significantly high as that of hemodynamic response. Hence further study is required to know the correlation between IOP and hemodynamics.

After all the statistical analysis we came to a conclusion that hemodynamic response had a significant higher value in intubated patients than LMA patients. But IOP response were not significantly high.

As an extra observation in our study we can see in the above tables that the hemodynamic response towards the end of 3 minutes returned to almost to their baseline value or nearer to their baseline value even in intubation group. This can also mean that even though there is a quick elevation in the hemodynamic response during intubation there is also a quick fall in the response after intubation. This is important because increase in hemodynamic response for very short interval may not actually effect patients adversely. But further study on this perspective is required to come to a conclusion.

CONCLUSION:

Hemodynamic response in intubated patients was higher than LMA patients but IOP response was comparable between both the groups. Hence LMA is preferred in patients where higher hemodynamic response is not advisable. But in cases which require stable IOP both the methods can be used as there was no major difference in IOP response between the two groups.

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