
CLINICAL INVESTIGATIONS

Intraocular pressure changes following laryngoscopy and intubation- McCoy versus Macintosh laryngoscope

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Background

We compared intraocular pressure changes following laryngoscopy and intubation with conventional Macintosh blade and McCoy laryngoscope.

Methods

Sixty adult patients were randomly assigned to study group or control group. Study group - (Group A, n=30) - McCoy laryngoscope was used for laryngoscopy. Control group (Group B, n=30) - conventional Macintosh laryngoscope was used for laryngoscopy. Pre-medication was given in the form of tablet alprazolam 0.25mg orally at bed time and two hours prior to surgery. Preoperative baseline intraocular pressure was measured with Schiotz tonometer after instillation of 4% xylocaine drops in the right eye. Injection thiopentone sodium 5 mgkg⁻¹ over 20 seconds was used for induction followed by injection vecuronium 0.1mgkg⁻¹ for intubation. All patients were manually ventilated using oxygen 33%, nitrous oxide 67% and halothane 0.5% for three minutes and ETCO₂ was kept below 40mmHg. Laryngoscopy was done as per group protocol. Size 7mm ID cuffed endotracheal tube was used for female patients and size 8mm ID for male patients in both the groups. Intraocular pressure and haemodynamic parameters were recorded just before induction of anaesthesia (baseline), just before laryngoscopy and intubation and 1 and 3 minutes after intubation.

Results

Patient characteristics, baseline haemodynamic parameters and baseline IOP were comparable in the two groups. Following induction (T₀), there was statistically significant fall in IOP in both groups. One minute after intubation (T₁), there was significant rise in IOP in both the groups and remained so even at three minutes after intubation (T₃). When compared in between the groups at one minute after intubation, the rise in intraocular pressure was significantly less in the study group (A).

Conclusion

We conclude that McCoy laryngoscope in comparison to Macintosh laryngoscope results in significantly less rise in IOP and clinically less marked increase in haemodynamic response to laryngoscopy and intubation.

Keywords: Intra-ocular pressure, McCoy laryngoscope, Macintosh blade, haemodynamic response.

Introduction

The goal of anaesthetic management during intraocular pressure (IOP), an immobile, ophthalmic surgery is to provide good control of uncongested operative field and cardiovascular

stability, combined with an adequate level of anaesthesia. Decrease in IOP minimizes the danger of expulsion of intraocular contents when the eye is opened.¹

Intraocular pressure (IOP) is defined as the pressure exerted by contents of eye against its containing wall. Intraocular pressure is considered normal within the range of 10-20mmHg but may range more widely in the general population. A diurnal variation of 2-3mmHg is normal. Intraocular pressure of 25mmHg or more is considered pathological.² Out of many factors controlling intraocular pressure intraocular blood volume is directly affected by changes in systemic arterial pressure and central venous pressure.³

During general anaesthesia, elevation of the IOP of short or longer duration may be due to multiplicity of factors acting from outside the globe e.g. extra ocular muscle contraction and pressure response to laryngoscopy and intubation. Laryngoscopy and endotracheal intubation is known to increase intraocular pressure, which may be of the order of 10-20mmHg. Laryngoscopy alone causes much more increase in IOP than intubation. Peak IOP occurs immediately after laryngoscopy and begins to decrease within 15 seconds⁴. Use of McCoy blade has been found to result in less significant rise in heart rate, arterial blood pressure and plasma adrenaline levels in comparison to Macintosh blade.⁵

Since there is a direct relationship between stress response to laryngoscopy and intubation and intraocular pressure, McCoy laryngoscope may be a useful alternative in minimizing the rise in IOP following laryngoscopy and intubation. Thus the present study was planned to evaluate the effect of McCoy laryngoscope on IOP following laryngoscopy and intubation and compare it with conventional Macintosh laryngoscope in patients undergoing elective surgery.

Methods

The present study was conducted in the Department of Anaesthesiology, Pt. B.D. Sharma PGIMS, Rohtak. It comprised of sixty adult patients of ASA grade-I and II, of either sex, between the age group of 20 to 50 years. Patients

scheduled for elective non ophthalmic surgery requiring general anaesthesia and endotracheal intubation such as cholecystectomy, mastectomy, pyeloplasty and mesh repair for herniae were included in the study. Patients with difficult intubation, low pulmonary compliance, obese patients and those with history of ischaemic heart disease (IHD) or hypertension were excluded from the study. The procedure to be carried out was explained and informed consent was taken for their participation in the study. Study was approved by institutional ethical committee. They were kept fasting, for minimum of six hours, prior to the scheduled time of surgery. Pre-medication was given in the form of tablet alprazolam 0.25mg orally at bed time and two hours prior to surgery.

On arrival in the operating room intravenous line was secured and standard monitoring (ECG, SPO₂, and NIBP) was instituted. Preoperative baseline intraocular pressure was measured with Schiotz tonometer after instillation of 4% xylocaine drops in the right eye, observing aseptic precautions. Before induction of anaesthesia, all the patients were randomly assigned to either of the following groups. Study group - (Group A, n=30) - McCoy laryngoscope (blade size 3 or 4) was used for laryngoscopy. Control group (Group B, n=30) - conventional Macintosh laryngoscope (blade size 3 or 4) was used for laryngoscopy. A standard anaesthetic technique was used in both the groups. Injection thiopentone sodium 5 mg/kg over 20 seconds was used for induction followed by injection vecuronium 0.1mg/kg for intubation. All patients were manually ventilated using oxygen 33%, nitrous oxide 67% and halothane 0.5% for three minutes and ETCO₂ was kept below 40mm Hg. Laryngoscopy was done as per group protocol. Size 7mm ID cuffed endotracheal tube was used for female patients and size 8mm ID for male patients in both the groups. Laryngoscopy and intubation was performed by the same observer in all the cases for consistency of observations. Thereafter, anaesthesia was maintained as per surgical requirements of that particular operation.

Observation:

During the study, following observations were noted.

1. Size of laryngoscope blade used.
2. Size of endotracheal tube (ETT) used.
3. Time taken for intubation: Time was noted in seconds from introduction of laryngoscope to the endotracheal tube cuff inflation.
4. Intraocular pressure (IOP): was measured at following times. The time required to measure IOP was less than 15 seconds.

T_B - Base line i.e. just before induction
T₀ - Just before laryngoscopy and intubation
T₁ - One minute after intubation
T₃ - Three minutes after intubation

5. Haemodynamic parameters:
Blood pressure (mmHg) - systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) and heart rate (beats per minute) were also recorded at the above mentioned times.

Results:

Demographic data was comparable in the two groups (Table-I). Time taken for endotracheal intubation was also comparable in both groups. Mean time taken for endotracheal intubation was 19.40±0.63 seconds in group A and 19.53±0.77 seconds in group B respectively. Baseline (T_B) IOP was comparable in both the groups (p>0.05, Table 2). Following induction at T₀, there was statistically significant fall in IOP in both the groups but was comparable in between groups. One minute after intubation (T₁), there was significant rise in IOP in both the groups and remained so even at 3 minutes after intubation (T₃). When compared in between the groups at one minute after intubation, the rise in intraocular pressure was significantly less in the study group (A). It was of the order of 4.88±0.61mmHg as compared to 6.62±0.50 mmHg in group B (p<0.05, Table 2). Haemodynamic response (HR,SBP,DBP,MBP) although clinically more marked in group B was statistically highly

significant at T₃ only with respect to SBP (p<0.001). It was of the order of 13.8±2.18mmHg in group B as compared to group A (5.8±2.61mmHg).

Table 1: Age, weight height and sex distribution in two groups

Parameters	Group A (n=30)	Group B (n=30)	P value
Age (years)	33.76±1.70	37.13±1.65	>0.05
Mean±SEM			
Weight (kg)	52.03±2.08	55.83±2.03	>0.05
Mean±SEM			
Height (cm)	161.50±1.15	163.73±1.11	>0.05
Mean±SEM			
Sex (male/female) (n)	6/24	11/19	>0.05

Table 2: Intraocular pressure (mmHg) in two groups at different time intervals (MEAN±SEM)

Group	T _B	T ₀	T ₁	T ₃
A	15.42±0.42	12.89±0.54	20.00±0.59	17.99±0.53
B	14.99±0.42	12.56±0.42	21.08±0.69	17.94±0.63

Table 3: Comparison of intraocular pressure changes (mmHg) in two groups at different time intervals (MEAN±SEM)

Group	T _B	T ₀ - T _B	T ₁ - T _B	T ₃ - T _B
A	15.42±0.42	2.52±0.30*	+4.88±0.61*	+2.57±0.60*
B	14.99±0.42	2.42±0.31*	+6.62±0.50*	+2.95±0.43*
p value in between groups	>0.05	>0.05	<0.05	>0.05

p value within group p* < 0.05 (significant), **p < 0.001 (highly significant).
'+' = increase, '-' decrease

Data was analysed using Chi square test (demographic profile of patients) and paired and unpaired 't' test (intraocular pressure).

Discussion

During intraocular surgery the control of intraocular pressure is very vital as sudden changes in IOP may cause complications such as iris prolapse, vitreous loss, retinal detachment or expulsive choroidal haemorrhage.⁶ Thus a smooth induction with minimal haemodynamic and IOP

response remains an important anaesthetic goal during ophthalmic surgery.

IOP depends on various factors but important are aqueous humour dynamics, changes in choroidal blood volume (CBV), central venous pressure (CVP), and extra ocular muscle tone.⁷ A sudden increase in systolic arterial blood pressure produces a transient acute rise in IOP until the aqueous outflow accommodates the rise.⁸ Obstruction of central venous return, increased central venous pressure or hypercapnia increase both CBV and IOP.³ Intraocular pressure may also rise markedly following pressure on the eye, contraction or contracture of extraocular muscles, contraction of the orbicularis oculi muscle, eyelid closure and venous congestion of the orbital veins.¹

Laryngoscopy with or without tracheal intubation can cause increase in arterial blood pressure and circulating catecholamine concentration. It has also been observed that the time course of IOP changes after tracheal intubation is similar to the time course of haemodynamic response to tracheal intubation.⁹

Various pharmacological interventions have been used to obtund this intra ocular pressure rise following laryngoscopy and intubation like second dose of propofol¹⁰, pretreatment with alfentanil¹¹ and remifentanil¹² etc. but none is full proof.

Use of supraglottic airway devices such as LMA have been advocated to decrease pressure response and IOP by avoiding laryngoscopy and tracheal intubation.⁹ It has been observed that with insertion of LMA arterial blood pressure, circulating catecholamine and IOP do not increase.¹³ The supraglottic structures are distorted by the laryngoscope blade, whereas the subglottic area is stimulated after the tube passes through the vocal cords.⁹ Use of McCoy blade improves visualization of larynx thus decreasing amount of forces applied during laryngoscopy and intubation. Consequently, the exaggerated reflex haemodynamic responses are clinically insignificant.¹⁴ We hypothesized that it should also help indirectly in attenuating the rise in IOP following laryngoscopy and intubation.

In this study baseline IOP was statistically comparable in both groups. IOP significantly decreased in both the groups following induction (T₀), but it was statistically comparable (Table 2 and 3). This may be due to effect of anaesthetic agents. Our results are similar to the studies of al-Abrak et al¹⁵, Lit Willer et al¹⁶ and Mirakhor et al.¹⁷ One minute after intubation (T₁) IOP increased significantly in both the groups and remained raised till three minutes after intubation (T₃). When compared in between the groups this rise in IOP following intubation was significantly more in group B as compared to group A at T₁. (Table 2).

It has been postulated that the increase in IOP associated with tracheal intubation may be secondary to increase in sympathetic activity. Adrenergic stimulation may cause vasoconstriction and an increase in CVP which has a closer relationship to IOP than systemic arterial pressure.² In addition, adrenergic stimulation can produce an acute increase in IOP by increasing the resistance to the outflow of aqueous humour in trabecular meshwork between anterior chamber and Schlemm's canal.⁹ As in the present study we did not measure catecholamine levels and CVP so it is difficult to comment on this aspect.

In our study although haemodynamic response was clinically more marked in group B but statistically significant difference was seen only at T₃ with SBP. It would have been more rational if we could have monitored CVP and catecholamine levels. McCoy laryngoscope has been evaluated for stress response to laryngoscopy and intubation by many authors¹⁴ and has proved to be beneficial but there was no study available of its use in relation to IOP.

In our study we observed less marked haemodynamic responses with McCoy although statistically it was comparable except for SBP at T₃. However there was statistically significant attenuation of IOP with McCoy at T₁. Thus we can conclude that McCoy laryngoscope can be utilized as a tool to obtund IOP response to laryngoscopy. However since our cases were non –ophthalmic further evaluation is needed in ophthalmic surgery.

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