Observational Study

A comparitive study of haemodynamic responses to laryngeal mask airway insertion and endotracheal intubation

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Earlier about 50 years back endotracheal intubation was considered the only proved technique of establishing a secure airway though associated with haemodynamic changes[1]. The aim of this comparative study was to know the haemodynamic changes following endotracheal intubation and LMA insertion. In 60 patients were randomly divided into 2 groups of 30 each. All the patients were pre – medicated with tab Famotidine 40 mg orally and tab lorazepam 1 mg night before and 2 hours prior to surgery. Before induction patients's baseline parameters were recorded. All patients were given inj Fentanyl 2 micrograms/kg i/v, were induced with inj Propofol 1-2.5 mg/kg i/v, Inj Atracurium Besylate 0.5 mg/kg i/v was given to achieve neuromuscular blockade. Subsequently in group A, tracheal intubation was performed, where as in group B patients LMA of was inserted blindly. The parameters were noted at 3 main stages – namely;- immediate pre-operative, immediate before airway instrumentation. At one, two, three and five minutes after airway instrumentation. Immediately after airway instrumentation heart rate rose which came back to normal baseline levels after 3-5 minutes but the rise in heart rate at one minute after endotracheal intubation is significantly higher than LMA insertion. The hemodynamic changes was more in endotracheal intubation than LMA insertion in the immediate post instrumentation period, thereby decreasing the risk of cardiovascular events in critically ill patients[2-4].

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Key words **: Anaesthesia, endotracheal intubation, laryngeal mask airway, supraglottic airway device, laryngoscopy.**

Materials and Methods

This prospective randomized study was carried out in the Department of Anaesthesiology, Mata Gujri Memorial Medical College, Kishanganj, Bihar. Sixty patients (20-45 years) belonging to ASA physical status I and II, were scheduled for various elective surgical procedures with likely duration of not more than 45 minutes, were selected. All the patients waiting for surgery were examined thoroughly, detailed history was taken along with the relevant preoperative investigations. Written informed consent was taken.

Exclusion Criteria :

Patients with history of cardiovascular diseases, gastroesophageal reflux disease, diabetes, respiratory disease, pregnancy and those on cardioactive drugs were excluded.

Premedication :

Tablet Famotidine 40 mg orally and tablet Lorazepam 1 mg orally with 15 ml of clear fluid, night before and 2 hours prior to induction of anaesthesia, i/v cannula was secured and multiparameter monitor was attached.

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Groups :

60 patients on whom the study was conducted were randomly divided into two groups of 30 each, on the basis of the airway device to be received on the operation table. All patients were given inj Fentanyl 2mgKg^{-1} i/v before the induction of the anaesthesia. All the patients were preoxygenated with 100% oxygen for 3 minutes. Inj Propofol at 1 -2.5 mg.Kg^{-1} i/v slowly till the eyelash reflex disappeared. Neuromuscular blockade was achieved by inj Atracurium besylate 0.5mg.Kg^{-1}i/v, patients were then ventilated with 100% oxygen[5,6].

Group A : Tracheal intubation was performed using a Macintosh Laryngoscope.

Group B : LMA was inserted blindly (by the standard technique[7,8,9]. Controlled ventilation was carried out with 66% nitrous oxide in oxygen from an anaesthesia machine adjusting the ventilation to maintain an end-tidal carbon dioxide level between 35-45mm of Hg. The various standard parameters of each patient was monitored by means of a multiparamater monitor and clinically correlated. The parameters were noted at the following specific stages in both the groups:

- Immediate preoperative, before the administration of any drug (baseline value).
- Immediate before airway instrumentation (ET intubation and LMA) but after induction of anaesthesia.
- At one, two, three and five minutes after airway instrumentation.

At the end of the surgical procedure, patients were adequately reversed with inj atropine sulphate0.02 $mgKg^{-1}$ and inj neostigmine 0.05–0.08 $mgKg^{-1}$. Postoperative recovery went uneventful.

Result : The results of the observations thus obtained in each group of patients (Group A and Group B) were tabulated, compiled and statistically analyzed using paired and unpaired "t" tests and repeated measures analysis of variance.

In each patient, the heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation recorded on the operation table in the immediate preoperative period before the administration of any drug, was taken as the baseline value in the study (Table 1).

P>0.05 – not statistically significant. p<0.05 – statistically significant. On statistical analysis of the heart rate comparison between group A and group B by using student's unpaired 't' test there was statistically significant difference (p<0.05) only at 5 minutes post airway instrumentation. The difference between heart rate at other times points being statistically insignificant (Table 2).

P>0.05 – not statistically significant. p<0.05 – statistically significant. A statistical significant difference in mean arterial blood pressure was found at one minute following airway instrumentation but at other time points the difference in mean arterial blood pressure was not statistically significant (p>0.05) (Table 3).

P>0.05 – not statistically significant. p<0.05 – statistically significant (Table 4).

P>0.05 – not statistically significant. p<0.05 – statistically significant. At one minute following airway instrumentation statistical significant difference was noted but at other time points the difference in end carbon dioxide concentration was not statistically significant (p>0.05) (Table 5).

Table 1 — *Showing immediate pre-operative (baseline) mean hemodynamic parameters between Group A and Group B*

Parameters	Group A	Group B
Heart Rate	79.60 ± 11.551	80.07 ± 8.554
Systolic Blood Pressure	122.60 ± 11.628	122.67 ± 9.596
Diastolic Blood Pressure	79.40 ± 10.457	79.07 ± 8.998
Mean Arterial Pressure	93.87 ± 10.054	93.87 ± 9.070
Sp02	99.17 ± 0.874	99.33 ± 0.844

Table 2 — *Showing comparison of mean heart rates in Group A and Group B at different points in time and their statistical analysis*

Points in time	Baseline	Mean heart rates over time – Group A *versus* Group B				
		Immediately before airway instrumentation	After airway instrumentation			
			1 min	2 min	3 min	5 min
Group A	79.6±11.151	81.20±11.050	100.93±12.709	88.13±11.688	79.53±10.228	73.53±10.444
Group B	80.07±8.554	80.87±8.029	95.37±10.179	87.4±9.088	83.10±8.252	81.80±7.814
'p' value (using an unpaired 't' test)	0.859	0.894	0.066	0.787	0.143	0.011
Interpretation	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p<0.05

Table 3 — *Showing comparison of mean arterial blood pressure in Group A and Group B at different points in time and their statistical analysis*

Points in time	Baseline	Mean arterial blood pressure over time – Group A *versus* Group B				
		Immediately before airway instrumentation	After airway instrumentation			
			1 min	2 min	3 min	5 min
Group A	93.87±10.054	86.83±9.624	120.13±8.119	102.70±8.945	95.17±9.060	92.33±7.009
Group B	93.87±9.070	85.27±8.038	110.40±7.403	100.55±7.199	95.40±6.971	92.20±6.661
'p' value (using an unpaired 't' test)	1.000	0.497	0.000	0.315	0.911	0.133
Interpretation	p>0.05	p>0.05	P<0.05	p>0.05	p>0.05	p>0.05

Discussion

To avoid life threatening complications like airway obstruction, aspiration of gastric contents etc especially in long surgical procedures[10,11], tracheal intubation was earlier considered the only main stays of airway management. Though with the actual process of tracheal intubation stress response aggravates disturbing the haemodynamic parameter. Studies proved that if no specific measures are taken to prevent haemodynamic responds, heart rate can increase to 26%-60% depending on method of induction and systemic blood pressure can increase from 36% - 45%.

LMA was introduced in 1983, as a first supra-glottic airway device which replaced ETT, along with a relatively secure airway[12-14] and less stimulating to the sympathetic nervous system, thereby decreasing the risk of adverse cardiovascular events. LMA is also tolerated at lighter planes of anaesthesia than an ETT, thus potentially decreasing the side effects; hence these life threatening complications due to endotracheal intubation can be minimized[15]. The LMA use is limited to certain patients and surgical procedures. Though certain limitations preclude the use of LMA in certain group of patients and surgical procedures, like in patients with full stomach (risk factors for aspiration), also its use is limited in patients with restrictive and obstructive lung disease or for laproscopic surgery. Though newer LMA designs aspire to address these limitations and to expand the use of supra – glottis ventilating techniques.

Table 4 — *Showing comparison of mean arterial oxygen saturation in Group A and Group B at different points in time and their statistical analysis*

Points in time	Baseline	Mean SpO2 over time – Group A *versus* Group B				
		Immediately before airway instrumentation	After airway instrumentation			
			1 min	2 min	3 min	5 min
Group A	99.17±0.874	98.70±1.022	99.13±0.900	99.13±0.900	99.13±0.937	99.13±0.900
Group B	99.33±0.844	99.07±0.868	98.97±0.928	99.17±0.913	99.17±0.834	98.90±0.995
'p' value (using an unpaired 't' test)	0.456	0.140	0.483	0.887	0.885	0.345
Interpretation	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05

Table 5 — *Showing comparison of mean end-tidal carbon-dioxide concentration in Group A and Group B at different points in time and their statistical analysis*

Points in time	Baseline	Mean ETCO2 over time – Group A *versus* Group B				
		Immediately before airway instrumentation	After airway instrumentation			
			1 min	2 min	3 min	5 min
Group A	39.67±2.426	39.37±1.847	39.37±2.282	38.70±2.003	39.20±2.140	39.47±2.360
Group B	39.03±1.299	38.93±1.780	39.07±1.552	39.33±1.729	38.80±1.472	39.07±1.639
'p' value using an unpaired 't' test)	0.000	0.359	0.009	0.426	0.029	0.013
Interpretation	p>0.05	p>0.05	p<0.05	p>0.05	p>0.05	p>0.05

Result Analysis and Conclusion

We found that immediately after airway management the heart rate rose which got back to almost baseline levels after three to five minutes but the rise in heart rate at one minute after endotracheal intubation in significantly higher than the LMA insertion. The observation corroborated with those of Fujii Y, *et al* (1995)[16] Asbury AJ (1990) notes significantly rise in heart rate above baseline value following LMA insertion which subsequently returned to baseline levels within seconds of the stimulus Ghai B *et al* (2001)[17] also found the changes in heart rate. We found a rise in systolic blood pressure after endotracheal intubation as compared to LMA insertion especially at one minute after intubation. Similarly we found a statistically difference and higher mean blood pressure one min after endotracheal intubation.

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