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COMPARATIVE STUDY OF STRESS RESPONSE USING INTUBATING LARYNGEAL MASK AIRWAY AND LARYNGOSCOPIC ENDOTRACHEAL INTUBATION UNDER GENERAL ANESTHESIA IN PATIENTS UNDERGOING ELECTIVE SURGERY

Anaesthesiology

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ABSTRACT

Introduction: Laryngoscopy and intubation is known to cause exaggerated stress response leading to hemodynamic changes and metabolic alterations. The stress response cause changes in serum levels of cortisol, glucose and lactate.

Various studies have compared hemodynamic response to tracheal intubation via Intubating Laryngeal Mask Airway (ILMA) versus direct laryngoscopy. We however compared metabolic parameters for stress response in terms of change in serum glucose, lactate and cortisol values before and after intubation with macintosh laryngoscope vs through Intubating LMA.

Material and Methods: The present randomized prospective study was carried out in our institute and after taking informed written consent on 70 ASA grade I/II patients aged 18-60 years of either sex, undergoing elective surgeries under general anesthesia. All patients were randomly allocated to two groups . Patients of Group I were intubated by intubating laryngeal mask airway, patients of Group M were intubated with Macintosh laryngoscope

A baseline ABG sample was taken before induction of anesthesia and then after intubation for comparison of glucose, and lactate levels. Similarly, baseline level of serum cortisol were done a day before surgery and then after intubation another blood sample sent for serum cortisol estimation.

Results: The statistical significant difference was found for mean post procedure serum cortisol values between IMA group and ET group (11.77±3.99 vs 15.36±5.13, $p < 0.05$). When we compared the change in levels of serum cortisol, glucose and lactate in both the groups we found that there was significant rise in serum cortisol, glucose and lactate after endotracheal intubation as compared to intubation through Intubating LMA

Conclusion: We concluded that ILMA is a safer alternative to direct laryngoscopy for intubation with less stress response in terms of change in metabolic parameters.

KEYWORDS

INTRODUCTION:

Stress response with laryngoscopy is an important concern for all anesthesiologists. Laryngoscopy and intubation is known to cause exaggerated stress response leading to hemodynamic changes and metabolic alterations which in turn may have deleterious respiratory, neurological and cardiovascular effects[1-4]. The stress response cause changes in serum levels of cortisol, glucose and lactate.

The pressor response to the laryngoscopy and tracheal intubation is known to be a sympathetic response provoked by stimulation of the epipharynx and larynx. The response is mainly caused by the laryngoscope blade pressing on the base of the tongue or by lifting of the epiglottis. The hemodynamic changes may cause rise in blood pressure and increase in cardiac rate which in turn cause metabolic changes or stress response in terms of hyperglycemia, increase in cortisol levels and other stress hormones.

The stress response to laryngoscopy and intubation can be reduced by either pharmacological methods or using alternative endotracheal tube guiding devices.[5-7]

A variety of supraglottic devices have been developed both for primary use as an airway device during anaesthesia and as a rescue device after failed ventilation or failed laryngoscopy/intubation. The laryngeal mask airway, a supra glottic airway device, can be inserted without the use of a laryngoscope and has been found to be useful in airway management in difficult airway and failed intubation.

Also LMA is designed to overcome the disadvantages of endotracheal intubation such as: soft tissue, tooth, vocal cords, laryngeal and tracheal damage, barotrauma etc. These devices can be used as a sole airway device during anaesthesia or as a bridge to intubation, since they will accommodate placement of a fibre-optic bronchoscope.

Intubating laryngeal mask airway (ILMA) a recently introduced LMA is used to ventilate patients, as well as act as conduit for endotracheal intubation which may be accomplished either blindly or with fibreoptic assistance. Although a standard curved Polyvinyl Chloride (PVC) ETT can be used but alternatively a specialized wire reinforced ETT can be uninterruptedly passed through the ILMA into the trachea.

The cuffed mask of the ILMA when seated over the glottis does not distort the pharyngeal wall structures. This lack of distortion of sensitive extra-glottic structures by the ILMA may result in less laryngeal stimulation and hence a reduced stress response. The present study was designed to compare the stress response during intubation by direct laryngoscopy and by ILMA. Various studies have compared hemodynamic response to tracheal intubation via Intubating Laryngeal Mask Airway (ILMA) versus direct laryngoscopy. There are very few studies comparing metabolic parameters for stress response hence in our study we compared the stress response in terms of change in serum glucose, lactate and cortisol values before and after intubation with macintosh laryngoscope vs through Intubating LMA.

Aim of the Study

The aim of the study was to compare the stress response following intubation with Macintosh laryngoscope and Intubating Laryngeal Mask Airway(ILMA) by estimation of changes in values of cortisol, glucose and lactate before and after intubation.

MATERIALAND METHODS:

The present randomized prospective study was carried out in our institute and after taking informed written consent on 70 ASA grade I/II patients aged 18-60 years of either sex, undergoing elective surgeries under general anesthesia.

After a complete preanesthetic checkup patients with hypertension, severe hepatic, renal, endocrine and cardiac dysfunction was excluded from the present study. Other exclusion criteria were patients with expected difficult airway (Mallampatti grade III and IV).

All patients were randomly allocated to two groups using sealed envelopes technique. Patients of Group I were intubated by intubating laryngeal mask airway, patients of Group M were intubated with Macintosh laryngoscope. All patients were kept fasting 6 hours prior to surgery. After arrival in the operation theatre, standard monitoring of heart rate, blood pressure SPO2 and ECG was done using multipara monitor. Intravenous line with 18 gauge (18G) cannula was secured in the non-dominant forearm and ringer lactate was started at the rate of 10 ml/kg. Intravenous midazolam 0.015 mg/ kg, fentanyl 2 microgram/kg and glycopyrrolate 0.005 mg/kg i.v. were given as

premedication before induction of anaesthesia. After preoxygenation for 3 min with 100% oxygen, anaesthesia was induced with intravenous thiopentone(5 mg/kg) followed by rocuronium bromide 0.9 mg/kg i.v. to facilitate tracheal intubation. The patients were manually ventilated by face mask with 100% oxygen till muscle relaxation was achieved . Patients of group I were intubated with proper size, cuffed endotracheal tube using Macintosh laryngoscope. In group II, a size 3 or 4 well lubricated (posterior surface) intubating laryngeal mask airway (3 for female, 4 for male) was inserted with the head in neutral position and the cuff was inflated with 20-30 ml of air (size 3:20 ml, size 4:30 ml). The ILMA was then attached to the anaesthesia breathing system and adequate ventilation was judged by bilateral equal chest wall movement and capnography (waveform). After confirmation that ventilation with the ILMA was unobstructed, a size 7.0 or 7.5, well lubricated reinforced, cuffed, tracheal tube was passed through the intubating laryngeal mask until it reached 15 cm depth marker and then advanced gently into the trachea without applying undue forces. When no resistance was felt, the cuff was inflated and the circuit reconnected. The correct tube placement was confirmed by the presence of bilateral breath by auscultatory method and by capnography. If resistance was encountered or oesophageal intubation occurred, adjusting maneuvers were applied. Tracheal intubation attempt was considered to be failed if it could not be accomplished when all adjusting maneuvers have failed and such patients were excluded from the study. These excluded patients were then intubated by direct laryngoscopy. After the tracheal intubation was successful, the ILMA device was removed using 25 cm stabilizing rod to maintain the tube in place to prevent accidental extubation. Maintenance of anaesthesia was achieved with isoflurane and 60% nitrous oxide in oxygen using closed circuit and controlled ventilation with vecuronium bromide 0.02 mg/kg. Hemodynamic parameters (heart rate, Spo2, NIBP, ECG) were also recorded at regular intervals (5 min) before intubation and also after intubation and before and after induction . All intubations were performed by a single experienced investigator. A baseline ABG sample was taken before induction of anesthesia and then after intubation for comparison of glucose, and lactate levels. Similarly, baseline level of serum cortisol were done a day before surgery and then after intubation another blood sample sent for serum cortisol estimation.

Statistical analysis

The results obtained were presented in tabulated manner, statistical analysis was done using SPSS software. P value of <0.05 was considered statistically significant and value of <0.001 is considered statistically highly significant.

RESULTS:

Baseline variables

	Intubating lma	E t intubation	P value by independent test
S.CORTISOL	10.59±3.62	8.72±2.70	**0.017**
GLUCOSE	106.86±16.75	108.17±30.31	0.823
LACTATE	1.26±0.63	1.05±0.53	0.13

Postprocedure variables

	Intubating lma	E t intubation	P value by independent test
S.CORTISOL	11.77±3.99	15.36±5.13	**0.002**
GLUCOSE	117.29±32.56	132.83±43.394	0.095
LACTATE	1.20±0.56	1.32±0.59	0.381

DISTRIBUTION OF MEAN CHANGE OF VARIABLES

	gp	N	Mean CHANGE	Std. Deviation	Std. Error Mean CHANGE	P VALUE (BY INDEPENDENT T-TEST)
CORTISOL CHANGE	LMA	35	.621714	3.9007273	.6593433	0.000(P<0.05)
	ET	35	6.643429	4.1117092	.6950057	
GLUCOSE CHANGE	LMA	35	10.43	23.806	4.024	0.022(P<0.05)
	ET	35	24.66	27.013	4.566	
LACTATE CHANGE	LMA	35	-.059714	.3228229	.0545670	0.002(P<0.05)
	ET	35	.274286	.5271136	.0890985	

The demographic profile of the patients, were comparable between the groups in term of their age, weight and sex. There was also no significant difference between both the groups in term of ASA physical status. On statistical analysis of preprocedural variables(Table 1), it was seen that there was significant difference in mean serum cortisol values between two groups ($p < 0.05$) while no such statistical significant difference was found between two groups for mean blood glucose and mean serum lactate values($p > 0.05$).

The statistical significant difference was found for mean post procedure serum cortisol values (Table 2)between IMA group and ET group (11.77±3.99 vs 15.36±5.13, $p < 0.05$). There was no statistical significant difference in mean post procedure blood glucose and mean post procedure serum lactate (117.29±32.56 vs 132.83±43.394; 1.20±0.56 vs 1.32±0.59) ($p > 0.05$). When we compared the change in levels of serum cortisol, glucose and lactate in both the groups (Table 3) we found that there was significant rise in serum cortisol, glucose and lactate after endotracheal intubation as compared to intubation through Intubating LMA.

DISCUSSION

Direct vision laryngoscopy for tracheal intubation is the conventional method for securing airway in various surgeries but laryngoscopy and intubation stimulate the pharyngeal tissues and lead to stress response. Although the stress response is short in duration, but may be undesirable in patients with pre-existing cardiac or neurological disease. However this stress response may be variable in different patients may be due to less experience and expertise of the person performing the intubations and also that of the assistant who is helping him in the procedure. Hence in our study in both the groups the procedure was performed by a single investigator.

After insertion of ILMA an assistant is required to first inflate the ILMA cuff for checking the ventilation, and then deflate the ET tube cuff to make it mobile, and finally re-inflate it after it has entered into the trachea. Various previous studies have compared the hemodynamic stress response in laryngoscopic intubation and intubation via other devices such as laryngeal mask airway[8-11]. Use of intubating laryngeal mask airway has been found to have less hemodynamic response in terms of heart rate and blood pressure as compared to conventional endotracheal intubation[12-14].

The possible cause attributed to less pressor response in ILMA group may be that ILMA neither require elevation of the epiglottis, nor does it stimulates the receptors at the base of the tongue as during laryngoscopy. This reduced oropharyngeal stimulation at supraglottic level and also at subglottic level due to soft tip, well lubricated silicone tube, and probably leads to lesser adrenergic stimulation than laryngoscope guided intubation.

In our present study we found that there was a significant increase in serum cortisol levels, glucose and lactate levels after intubation via macintosh laryngoscope vs that in intubation via ILMA. Hence we found that there is a significantly more stress response occurring after laryngoscopic intubation vs intubation through Intubating LMA.

The stress hormone cortisol is a powerful promoter of gluconeogenesis in the liver , and acts on the glycogen storage in the liver as well as on the reduction of glucose utilization in peripheral tissues. Growth hormone and prolactin have a role in stress, probably by their hyperglycemic action in the liver .

Protein degradation in skeletal muscle, glycolysis, and gluconeogenesis are the prominent characteristics of intermediary metabolism in patients under surgical stress conditions. Promotion of gluconeogenesis by cortisol in the liver is caused primarily by the stimulation of protein catabolism. The rate of the overall metabolism is increased in stress conditions, but the capacity of oxidative metabolism is limited. This is one of the main reasons why catabolic pathways begin to work unaerobically and to produce, among other metabolites, lactate.

A study by Mujagić et al[15] showed that serum levels of glucose and lactate were increased during surgical treatment, and that this increase

was more pronounced in patients treated under general balanced anesthesia with isoflurane than in those under TIVA with propofol. Multimodal approaches combining anesthetic, analgesic and surgical strategies will result in better control of glycemia during the intra- and perioperative periods, and thus in improved clinical outcome.

Rastogi et al[16] in their study concluded that ILMA is a safer alternative to Macintosh laryngoscope as ILMA attenuated the hemodynamic stress responses to tracheal intubation and hence may be preferred in hypertensive patients

In another similar study[17] also the authors found that, there was clinically significant increase in hemodynamic variables in intubation performed with macintosh laryngoscope and very minimal response in the group in which intubation was done via intubating LMA.

Conclusion

Intubating Laryngeal Mask Airway (ILMA) can maintain airway and oxygenation of the patient throughout the intubation procedure. ILMA offers advantage in attenuating the stress responses compared with direct laryngoscopic stimulation. Hence we conclude that ILMA is a safer alternative to direct laryngoscopy for intubation.

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