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Original research article

IV Dexmedetomidine and IV esmolol in laryngoscopy and endotracheal intubation in laparoscopic surgeries: Heart rate changes

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Abstract

A powerful noxious stimulus like laryngoscopy and tracheal intubation induces hypothalamic activity and results in an increased outflow in the sympathetic tracts. Consequently norepinephrine is released by post ganglionic sympathetic fibers and increased secretion from adrenal medulla. Attempts have been made to assess sympathetic activity directly by measurement of plasma catecholamine concentrations with the use of radio enzymatic assays and high pressure liquid chromatography, by various workers. The study involves the patients undergoing laparoscopic surgeries of the age group between 15 to 50 years. Informed written consent was taken from the patients of age 18 to 50 years and for those between 15 to 18 years, assent from the patient and informed written consent from the parents/guardian was obtained. All the patients were assessed preoperatively with history, clinical examination and required investigations. There was significant increase in the mean HR observed at 5th, 10th and 15th minute after laryngoscopy and intubation in group E and the heart rate reached the basal value by 5th minute in group E. When compared to group D, mean HR was maintained below the baseline which was seen statistically significant with the P value (<0.001) throughout the study period.

Keywords: Dexmedetomidine and esmolol, endotracheal intubation, heart rate changes

Introduction

Sympatho-adrenal system regulates the body response to combat any stress. The neurotransmitters of the sympathoadrenal system are noradrenaline and adrenaline. Normal basal secretion by adrenal medulla of adrenaline is 0.2 µg/kg/minute and that of noradrenaline is 0.05 µg/kg/minute which are adequate to maintain the body physiology. In situations of stress the sympathoadrenal system is stimulated by hypothalamus resulting in an increase in the catecholamine secretion. This reaction is closely correlated with endocrine system in combating stress [1, 2].

The sympathetic system in response to stress acts to increase heart rate, blood pressure, cardiac output, dilates bronchial tree and shunts blood away from skin and viscera to muscles [3].

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Consequently norepinephrine is released by post ganglionic sympathetic fibers and increased secretion from adrenal medulla.

Attempts have been made to assess sympathetic activity directly by measurement of plasma catecholamine concentrations with the use of radio enzymatic assays and high pressure liquid chromatography, by various workers [4].

It was concluded by study of changes of plasma catecholamine concentration during laryngoscopy and endotracheal intubation by Russell WJ and Mortis RG5 that a positive correlation existed between arterial pressure and plasma noradrenaline concentration. The magnitude of increase in blood pressure paralleled the increase in plasma noradrenaline concentration. Plasma adrenaline did not change significantly.

This was further confirmed by Derbyshire6 and Smith [7] who showed that the plasma noradrenaline concentration increased by 34% in samples obtained from central venous line and by 74% in samples obtained from radial artery. This can be explained by uptake of noradrenaline in lungs.

The adrenergic response was maximum by one minute and had diminished by 5 minutes. This haemodynamic response due to activation of sympatho-adrenal system increases heart rate, blood

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pressure and these serve as indirect indices to measure the response. Thus heart rate and blood pressure have been used as indirect indices to measure levels of sympathetic activity clinically [8].

In addition to activation of the autonomic nervous system, endotracheal intubation also stimulates central nervous system activity as evidenced by increase in electroencephalographic activity and basal metabolic rate. In patients with compromised intracranial compliance, the increase in CBF may result in elevated intra cranial pressure which in turn may result in herniation of brain contents and severe neurologic compromise.

Methodology

Source of data

American Society of Anaesthesiologists (ASA) I and ASA II patients aged 15- 50 years undergoing elective laparoscopic surgeries under general anesthesia.

Type of study: Interventional study.

Sampling technique: Simple random sampling by lottery method.

Sample size: Sample size was calculated by previous records of all the laparoscopic surgeries in the department of Anaesthesia.

According to last year's data, the average sample size found to be around 60.

Sample size = years of study x 1 year data + 10% drop out rate

= 2 x 60 + 12

Total sample = 132 Group D - 66, Group E– 66

Inclusion Criteria

1. Patients of age 15-50 years belonging to ASA I and II.
2. Patient willing to give informed consent.
3. Patients undergoing elective laparoscopic surgeries.
4. Patients of both gender.

Exclusion Criteria

1. Patients with Secondary Hypertension
2. Patients with Co-morbidities like Diabetes mellitus, Coronary artery disease, Cerebrovascular accidents.
3. Pregnancy.

After obtaining approval and clearance from institutional ethical committee, 132 patients fulfilling the inclusion criteria will be enrolled for the study after obtaining informed consent.

The study involves the patients undergoing laparoscopic surgeries of the age group between 15 to 50 years. Informed written consent was taken from the patients of age 18 to 50 years and for those between 15 to 18 years, assent from the patient and informed written consent from the parents/guardian was obtained. All the patients were assessed preoperatively with history, clinical examination and required investigations.

The patients were randomly allocated into two groups either by lottery method into

Group D (no. 66) received Dexmedetomidine 1 µg/kg in 10 ml normal saline i.v. over 10 min, 5 min before induction of anaesthesia.

Group E (no. 66) received Esmolol 1.5 mg/kg in 10 ml normal saline i.v. over 10 min, 5 min before induction of anaesthesia.

The respective drug to be given was prepared by the senior resident who randomly allocates the patients into respective group.

The intra operative monitoring was done by the researcher as per the scale.

Results

Table 1: Age in years – Frequency distribution of two groups of patients studied

Age in Years	Group D	Group E	Total
18-30	29(43.9%)	29(43.9%)	58(43.9%)
31-40	18(27.3%)	18(27.3%)	36(27.3%)
41-50	19(28.8%)	19(28.8%)	38(28.8%)
Total	66(100%)	66(100%)	132(100%)
Mean ± SD	33.62±9.75	33.64±9.04	33.63±9.37

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Samples are age matched P=0.993, student t test

There was no significant difference in the age of the patients between group D and group E.

Table 2: HR (per/min) - comparison in two groups of patients studied

HR	Group D	Group E	Total	P Value
Baseline	84.26±13.82	85.52±4.54	84.89±10.27	0.484 (NS)
1 min after study drug	77.83±13.27	84.91±5.07	81.37±10.62	<0.001 (HS)
1 min after induction	76±12.92	84.64±5.02	80.32±10.68	<0.001 (HS)
1 min after intubation	72.06±11.26	84.14±5.28	78.1±10.65	<0.001 (HS)
3 min	71.82±10.52	82.41±5.26	77.11±9.84	<0.001 (HS)
5 min	77.53±10.86	87.77±5.35	82.65±9.96	<0.001 (HS)
10 min	80.33±9.55	99.82±5.11	90.08±12.4	<0.001 (HS)
15 min	77.56±9.3	98.32±4.39	87.94±12.69	<0.001 (HS)

(p<0. 01) Highly Significant (HS); (p<0.05) – Significant (S), (p>0.05) Not Significant (NS)

There was significant decrease is mean HR in group D after 1 min after study drug, 1 min after induction, 1 min after intubation and at various time intervals after laryngoscopy and intubation upto 15 minutes.

There was significant increase in the mean HR observed at 5th, 10th and 15th minute after laryngoscopy and intubation in group E and the heart rate reached the basal value by 5th minute in group E. When compared to group D, mean HR was maintained below the baseline which was seen statistically significant with the P value (<0.001) throughout the study period.

Discussion

Laryngoscopy and Endotracheal intubation provoke a transient, but marked sympathetic and response leading to hypertension and tachycardia. In situations when laryngoscopy and intubation is difficult or when a high risk patient is involved (coronary artery disease, intracranial hypertension, and intracranial aneurysm) it would seem prudent to pharmacologically attenuate blood pressure surges associated with laryngoscopy and intubation. Various drugs have been used to attenuate this post intubation hemodynamic response such as opioids, beta blockers, calcium channel blockers, local anaesthetics, magnesium sulphate etc [9].

No single drug or anaesthetic technique has been accepted to be completely effective in attenuating this sympathetic response. The methods which are being used are either partially effective or produce undesirable side effects.

The α-adrenoceptors are involved in regulating the autonomic nervous system and cardiovascular systems. α2-adrenoceptors are located on blood vessels, where they mediate vasoconstriction and on sympathetic presynaptic terminals where they inhibit epinephrine and nor- epinephrine release. α2-adrenoceptors are also located within the central nervous system and their activation leads to sedation, a reduction of tonic levels of sympathetic outflow and an augmentation of vagal activity. This can result in a decrease in HR and cardiac output. The use of α2 - agonists in the peri-operative period has been associated with reduced anaesthetics requirements and attenuated HR and blood pressure responses to stressful events.

There was no significant difference in the basal heart rate among both the groups.

There was a significant decrease in heart rate in the group D after 1 min after study drug, 1 min after induction, 1 min after intubation and at various time intervals after laryngoscopy and intubation upto 15 minutes compared to Esmolol group found a continuous gradual reduction of HR as in our study.

With Esmolol group, there is decrease in HR observed upto 3 minutes after laryngoscopy and intubation and HR reached to baseline by 5th minute.

However, Dexmedetomidine group showed better attenuation of HR compared to Esmolol group which was statistically highly significant. The HR decreases compared to the basal value at 3rd minute after laryngoscopy and intubation and the HR remained below the basal value at all the time intervals after laryngoscopy and intubation which was statistically highly significant (p<0.001) when compared to group E. This is in conjunction with the studies done by Chodankar ND *et al*., Bitan Sen *et al*., Badri Narayana Chigullapally *et al*.

Conclusion

In the Dexmedetomidine group, there was a statistically significant fall in HR which remained below the basal values as compared to the Esmolol group at 3rd, 5th, 10th and 15th min after laryngoscopy and intubation which was statistically highly significant.

In Esmolol group, the HR returned to baseline value at 5th min after intubation, There was no side effects noted in both the groups in our study.

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