Original Article

Attenuation of Pressor Responses to Laryngoscopy and Endotracheal Inbtubation with Intravenous Esmolol Vis-À-Vis Intravenous Lignocaine in Cardiac Diseases (A Comparative Study)

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Summary

The effect of i.v. esmolol and lignocaine in anaesthetized patients during laryngoscopy and intubation was studied in 90 patients with various cardiac diseases. Pulse rate, systolic and diastolic blood pressure and mean arterial pressure were measured to assess the cardiovascular response. It was concluded that Esmolol was significantly superior to Lignocaine in blunting the haemodynamic response to laryngoscopy and tracheal intubation.

Keywords: Cardiovascular response, laryngoscopy, intubation, attenuation, esmolol, lignocaine

Introduction

Laryngoscopy and endotracheal intubation, an integral part of anaesthetic procedures, is an invasive method of ventilating patient under anaesthesia. Significant cardiovascular changes as depicted by the rise in blood pressure (by 40%) and heart rate (by 20%) are well documented during this procedure, which causes mechanical stimulation to epipharynx, laryngopharynx and tracheobronchial tree causing increased reflex sympathetic activities (releasing catecholamines) (3,4,5,7,11,20,21,29) The response is self limiting and well tolerated in healthy individuals. However, it may be hazardous to patients with hypertension, myocardial insufficiency and cerebrovascular diseases.(9) With varying effect, a number of pharmacological modalities (Opioids:Fentanil, _-2- agonist: e.g. Clonidine, _- Blockers e.g. Propanolol) and techniques (Uses of Fibreoptic Laryngoscope & Mc coy Laryngoscopic Blade) have been put into practice to ameliorate the cardio-vascular effects of endotracheal intubation.

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Materials

The present study consisted of a total populatio of 90 patients of either sexes scheduled for variou corrective cardiac surgical procedures under genera anaesthesia. They were in ASA Grade II & Grad III.Age groups of all patients were between 18-5 years. Patients were excluded from the study if the were less than 18 or more than 55 years old or i they had known allergy/hypersensitivity to Esmolo and Lignocaine or if they had COPD/ Asthma o AV Block.or hypotension /severe hypertension o bradycardia. Difficult intubation (Mouth opening < 2cm,thyromental distance < 3cm) cases were also excluded. Any case requiring more than 10 seconds for intubation will be excluded as stimulus fo longer period may cause exaggerated presso response. The study was conducted i cardiothoracic center, Pune.

Methods

This is a randomized controlled study. The patient were randomly allocated to three groups each consisting of 30 patients. Group A (Controlgroup did not receive Esmolol or Lignocaine.Group B received Esmolol.Group C received Lignocaine. Al received Diazepam 0.1mg/kg orally at 2200hrs th night prior to surgery and the same dose in th morning of surgery at 0600 hrs.In the OT monitoring was applied before medication an included an electrocardiogragh for heart rate an ECG, and.pulse oximeter. Under L/A (2 lignocaine), radial artery was cannulated and th pressure tubing was attached to transducer an hence to invasive blood pressure monitor.Followin a 3 minute preoxygenation (O2 – 6 ltr./min. anesthesia was induced with thiopentone in sleepdose. (3-5 mg/kg titrated to effect). It was ju preceded by muscle relaxation with non depolarizing group viz.i.v. Vecuronium 100 µgm

kg, followed by Esmolol 0.5mg/kg i.v. (Gr. B. received 3 min before intubation.b) Lignocaine 2 mg/kg i.v. (Gr.C. received 3 min before intubation).

Laryngoscopy (Mcintosh) was performed followed by intubation after 3 minutes of administration of above drugs and after 3 minutes in Group A without administration of above drugs. The tube was secured after confirming equal air entry bilaterally in the chest. The patients were not draped/ cleaned or positioned for first 15 minutes after intubation to avoid stimuli. Maximum HR.& Intra-arterial BP (SAP, DAP, & MAP) were recorded before induction (X), at the time of induction (Y),during intubation (Z),after intubation, for duration of 10 min. at an interval of 2 minutes (Z_2, Z_4, Z_6, Z_8, Z_{10},) & after 15 minutes (Z_{15}).Anaesthesia was maintained by O_2 (33%) , N_2O (66%) and Isoflurane (0.5 – 1%) . After recording the last reading (at 15 minute) injection, fentanyl 2 µgm/ kg . I.V. was given; Fentanil is also a good drug to obtund the pressor response. No opioid was used in pre-medication Statistical Analysis was carried out through ANOVA as there were more than 2 groups which were compared by unpaired 't' test and mean values were compared between groups B & C.

Observation And Results

Sex	Group A	Group B	Group C	Total
Males	15	15	15	45
Females	15	15	15	45
Total	**30**	**30**	**30**	**90**

Table –I: Sex distribution

Age	Group A	Group B	Group C	Total
18-20	5	5	5	15
21-30	5	5	5	15
31-40	5	5	3	13
41-50	5	5	12	22
51-55	10	10	5	25
Total	**30**	**30**	**30**	**90**

Table –II: Age distribution

	Group A	Group B	Group C	Total
CAD	10	10	10	30
VHD	10	10	10	30
CHD	10	10	10	30
Total	30	30	30	90

Table –III: **Disease distribution**

Legend:

CAD (Coronary artery diseases) included double & triple vessel diseases

VHD (Valvular heart diseases) included MS, MR, AS, & AR

CHD (Congenital heart diseases) included ASD, & VSD.

	CHD	VHD	IHD	Total
18-20	13	5	-	18
20-30	10	10	-	20
31-40	5	10	-	15
41-50	2	5	10	17
51-55	-	-	20	20
TOTAL	**30**	**30**	**30**	**90**

Table –IV: Disease V/S age profile

ASA Status	Group A	Group B	Group C	Total
II	5	5	5	15
III	25	25	25	75
TOTAL	**30**	**30**	**30**	**90**

Table –V: ASA physical status

Type of surgery	Group A	Group B	Group C	Total
AVR	4	4	4	12
MVR	5	5	5	15
DVR	1	1	1	3
CABG	10	10	10	30
VSD Correction	5	5	5	15
ASD Correction	5	5	5	15
Total	30	30	30	90

Table –VI Categorization of the surgery

Legend:

AVR – Aortic Valve Replacement

MVR - Mitral Valve Replacement

DVR - Double Valve Replacement

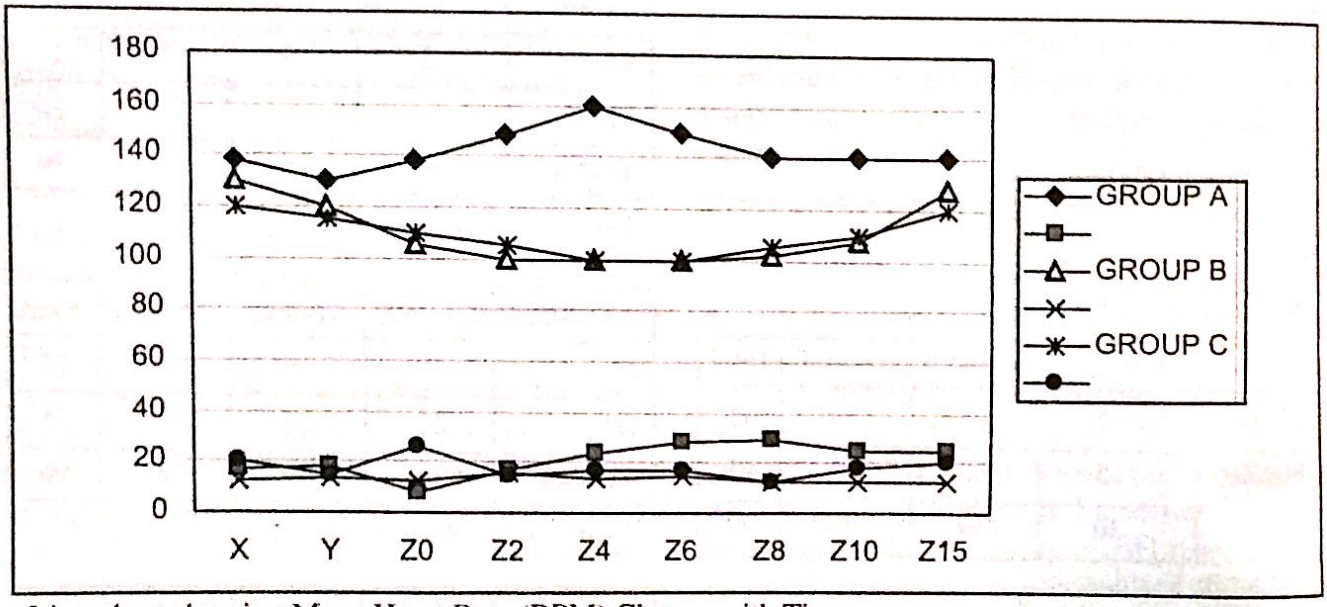
CABG - Coronary Artery By Pass Grafting

VSD - Ventricular Septal Defect

ASD- Atrial Septal Defect

	X	Y	Z_0	Z_2	Z_4	Z_6	Z_8	Z_{10}	Z_{15}
GROUP A	90 ±8.2	94 ±10.4	100 ±8.3	110 ±7.3	120 ±10.4	118 ±11.6	115 ±10.2	110 ±8.4	100 +5.2
GROUP B	90 ±8.3	88 ±5.1	88 ±4.2	80 ±3.4	74 ±4.5	78 ±5.6	80 ±6.2	84 ±7.2	88 ±8.2
GROUP C	92 ±7.1	94 ±8.2	90 ±6.7	88 ±7.4	94 ±8.3	90 ±7.2	90 ±8.2	90 ±8.1	90 ±9.1

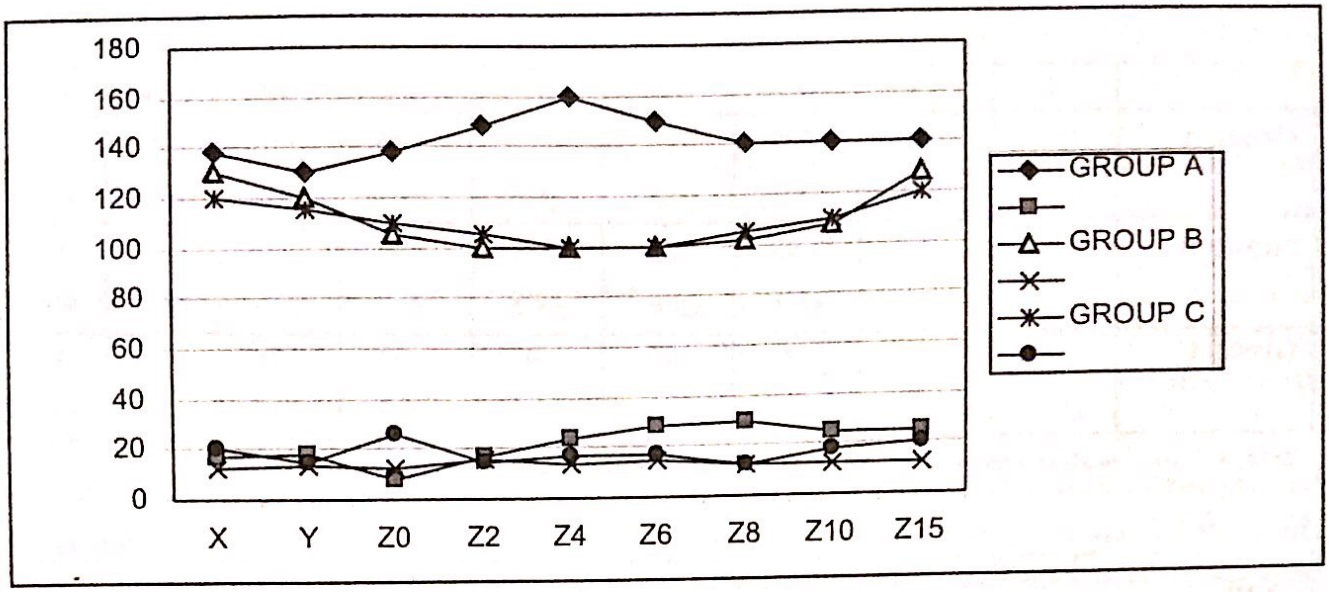
Table 1: Changes in heart rate at various intervals after laryngoscopy and endotracheal intubation values expressed as mean + SD



Line chart showing Mean Heart Rate (BPM) Change with Time

	X	Y	Z_0	Z_2	Z_4	Z_6	Z_8	Z_{10}	Z_{15}
GROUP A	138 ±17.2	130 ±18.3	138 ±8.3	148 ±16.5	160 ±24.3	150 ±28.4	140 ±29.9	140 ±25.1	140 ±25
GROUP B	130 ±11.9	120 ±13.3	105 ±12.7	100 ±16.1	100 ±14.1	100 ±14.5	102 ±12.9	108 ±12.5	128 ±12
GROUP C	120 ±20	115 ±15.1	110 ±26.2	105 ±15	100 ±17	100 ±17	105 ±13	110 ±18.1	120 ±20.1

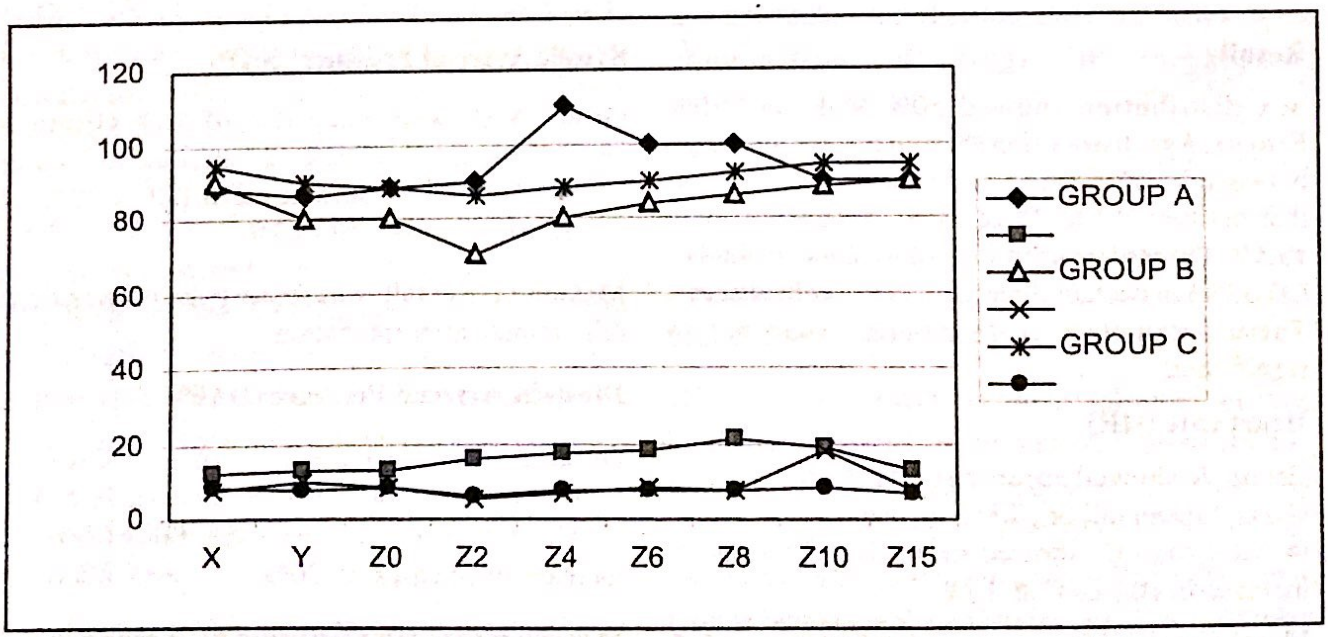
Table 2: Change in systolic arterial pressure at various intervals after laryngoscopy and intubation Values expressed as mean + SD



Line chart showing nean SAP (mmHg) change with time

	X	Y	Z_0	Z_2	Z_4	Z_6	Z_8	Z_{10}	Z_{15}
GROUP A	88 ±11.7	86 ±13.1	88 ±12.6	90 ±15.7	110 ±17.5	100 ±18.3	100 ±20.9	90 ±19	90 ±13.2
GROUP B	90 ±7.9	80 ±10	80 ±8.1	70 ±5.2	80 ±7.1	84 ±8.2	86 ±7.3	88 ±18.3	90 ±7.8
GROUP C	94 ±8.1	90 ±7.4	88 ±8.2	86 ±6.4	88 ±7.2	90 ±7.3	92 ±7.4	94 ±8.1	94 ±7.1

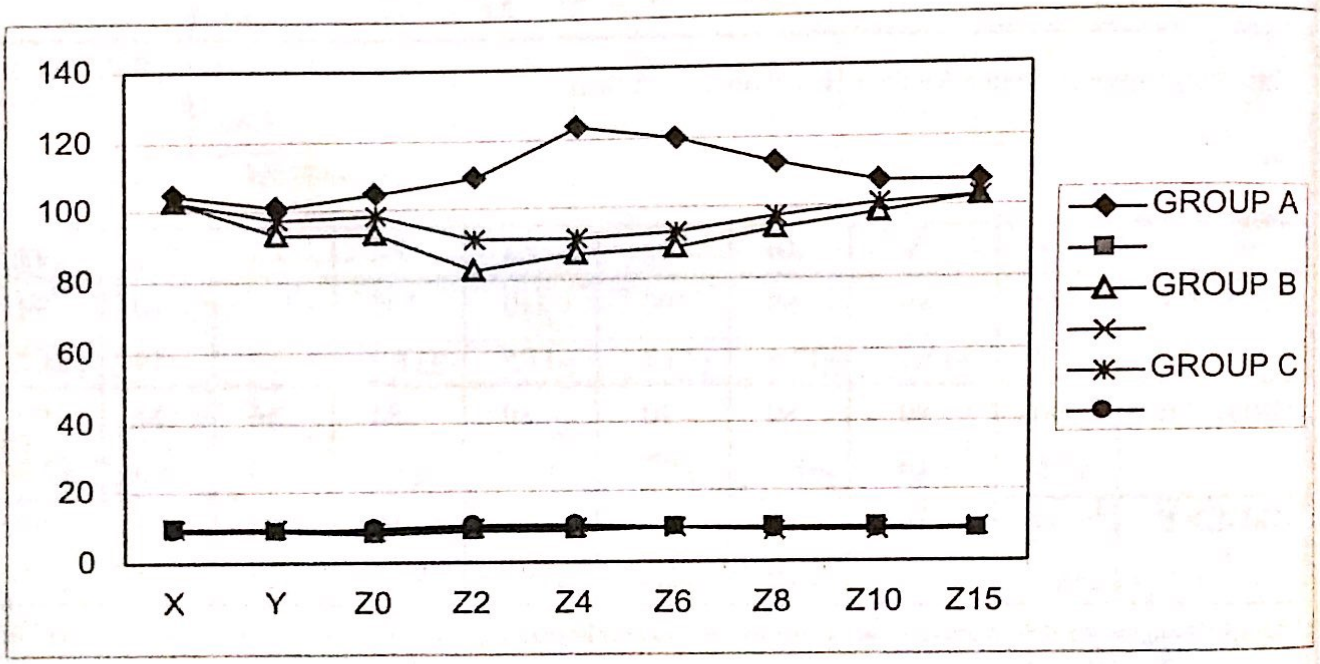
Table 3: Change in diastolic arterial pressure at various intervals after laryngoscopy and intubation values expressed as mean + SD



Line chart showing mean DAP (mmHg) change with time

	X	Y	Z_0	Z_2	Z_4	Z_6	Z_8	Z_{10}	Z_{15}
Group A	105 ±10.1	101 ±8.9	105 ±8.1	109 ±8.5	123 ±8.4	120 ±9.5	113 ±9.5	107 ±9.6	107 ±9.1
Group B	103 ±9.4	93 ±9.5	93 ±8.5	83 ±9.6	87 ±9.8	89 ±9.7	94 ±8.5	99 ±8.9	103 ±9.6
Group C	103 ±8.8	98 ±8.9	99 ±10.1	92 ±10.3	92 ±10.8	93 ±9.5	98 ±9.2	101 ±8.5	103 ±8.8

Table 4: Change in Mean arterial pressure at various intervals after laryngoscopy and intubation values expressed as mean + SD



Line chart showing MAP (mmHg) change with time

Results

Sex distribution showed 50% Male and 50% Female. Age distribution showed that the age range between 51-55 covered a maximum of 22.5 % and that between 18 to 20 & 21 to 30 covered only 13.5%. Disease distributions showed equal number (33.33%) in each of three groups of cardic disease. These parameters of distribution were not so significant.

Heart rate (HR)

Group A showed mean rise of 33.%.Group B showed mean fall of 17.7%. & increase in 5 cases @ 5%.Group C showed mean rise of 0.02%. & increase in 10 cases @ 10%

Maximum rise / fall was found to be between 2 & 4th minute after intubation.

Sytolic Arterial Pressure (SAP)

Group A showed mean rise of 16%.Group B showed mean fall of 20%. & increase in 2 cases @ 2% Group C - showed mean fall of 12%. & increase in 10 cases @ 15.3%

Maximum rise/ fall was found to be between 2 & 4th minute after intubation.

Diastolic Arterial Pressure (DAP)

Group A showed mean rise of 25%.Group B showed mean fall of 22.9%. & increase in 2 cases @ 5% Group C showed mean fall of 6%. & increase in 10 cases @ 20%

Maximum rise/ fall was found to be between 2 & 4th minute after intubation.

Mean Arterial Pressure (MAP)

Group A showed mean rise of 17%. Group B showed mean fall of 19%. and increase in 2 cases @ 4% . Group C showed mean fall of 10%. & increase in 10 cases @ 12.7%

Maximum rise/ fall was found to be between 2 & 4th minute after intubation.

Esmolol was significantly superior to Lignocaine in blunting the haemodynamic response to laryngoscopy and tracheal intubation. ($P< 0.05$)

Discussion

Reid and Brace (1940) were the first to report the circulatory responses to laryngeal and tracheal stimulation in anaesthetized man.(19) These were tachycardia and a rise in aterial pressure. King et al (1951) found that during light general anaesthesia, when the epiglottis was elevated by a laryngoscope, there was an increase of systolic and diastolic pressure within 5 second. (12) Directly mediated reflexes, laryngovagal { Airway spasm, apnea, bradycardia, arryhythmia or hypotension}, laryngosympathetic {tachycardia, tachyarrhythmia or hypertension} and laryngospinal {Coughing, Vomiting or bucking} provide the final source of morbidity. Osamu, Yoshihirol, Masakatsu S., Hidenori T (1998) have shown that Skin Vasomotor Reflex (SVmR) predicts circulatory responses to laryngoscopy and intubation. The recent development of a laser Droppler flow- meter, which nonivasively measures skin surface local blood flow, is a useful tool to observe skin vasomotion. SVmR is mediated by sympathetic nerves, because an _-1 antagonist significantly reduces the amplitude of the SVmR, and a burst of skin sympathetic nerve activity preceeds the decrease in flow.(17) The minimal alveolar concentration (MAC- BAR) for endotracheal intubation is about 30% higher than MAC for surgical incision requiring a relatively deep level of anaesthesia to be established.

Korenga et al (1985), Donald et al (1990), Shane et al (1990), Miller et al (1991), Helfman et al (1991), Chung et al (1992) Purdy et al (1992), Korpinen et al (1995), H Singh et al (1995), Kindler et al (1996), & S Dutta et al (1999) , also found that Esmolol was a better drug.(8,10,22,23,25,) C.D. Miller and S.J. Warren (1990) showed lignocaine 1.5 mg kg-1 given I.V. within 3 min of laryngoscopy failed to attenuate the cardiovascular responses to laryngoscopy and intubation. (24) Therefore lignocaine 2mg / kg was given 3 minutes prior to intubation in this study.

V. Mehta, C.P. Bhasin and R.Sood, (1998) showed that peak rise in Esmolol group was 7.1 % in HR, 2.7% in SBP 3.8% in MAP 4.3% in DBP from base value compared to 13.0% in HR, 11.9 % in SBP, 14.6% in MAP, 15.6% in DBP in lignocaine group. (28) They used Esmolol 100 mg and lignocaine 1.5mg/kg 2 minute before intubation. It is highly comparable with our study.

Conclusion

The anesthetic sequence is full of stress to the patients. There is a demonstrable tachycardia and hypertension following laryngoscopy and intubation. Normal schedule of premedication and anaesthesia is not able to suppress this stress response, which lasts for approximately 10 minutes or even longer. The response can be ameliorated by using a beta blocker (Esmolol) and Class Ib antiarrythmic drug (Lignocaine), and better by a combination of drugs or techniques. (18,16,15,14,10,8,6)

Esmolol is an ultrashort acting drug which by its brief action and cardioselectivity is near ideally suited to blunt the haemodynamic intubation response in comparison to widely used Lignocaine.(27,25,23,22,)

IV Esmolol administered 3 minutes before intubation prevents the unwanted haemodynamic response in patients with VHD, CHD, IHD, thereby avoiding the serious life threatening complications like ventricular tachycardia, acute left ventricular failure, myocardial ischaemia and cardiovascular accident.

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