Attenuation of haemodynamic responses of laryngoscopy and endotracheal intubation: An evaluation of efficacy of single intravenous dose of esmolol hydrochloride

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Abstract

Mitigating stress responses of laryngoscopy and endotracheal intubation is critical in management of general anesthesia patient undergoing surgical intervention. This becomes particularly detrimental and critical in patients with hypertension and cardiovascular cerebral disease affecting immediate and long-term outcomes. Role of beta blockade remained limited due to long duration, irreversibility and rebound withdrawal in acute care settings; which led to discovery of cardioselective short acting esmolol hydrochloride (t1/2- 2.5 to 9 min). In this randomized controlled double-blind prospective trial, we studied intravenous esmolol hydrochloride in 2 different single intravenous bolus doses (Group I - control, Group II - 1mg/Kg, Group III- 1.5mg/kg) in ASA 1 and 2 elective normotensive patients. Statistical analysis was done by using paired-t test. Study concluded that esmolol HCL pretreatment after induction with Thiopental Na before laryngoscopy and intubation allowed unique titration of esmolol doses and monitoring of side effects like bradycardia and hypotension and at the same time significantly attenuated sympatho-adrenal response of rise in pulse, mean arterial pressure (MAP), rate pressure product (RRP) and arrhythmia. Esmolol acts differently in different doses. In 1mg/Kg it effectively controls (P<.001) post intubation rise in pulse. Higher dose of 1.5mg/kg is required to control (P<.001) MAP. Rate pressure product is attenuated in group II (P<.01) and group III (P<.001), indicating that esmolol effectively reduces oxygen consumption by heart and likely prevents ischemia in vulnerable patients. Bradycardia of transient nature is seen in some patients in both test groups, reversed by reducing halothane without any treatment. Perioperative side effects like hypotension and bronchospasm that require stopping the test drug esmolol, were not seen in any of test groups, indicating safety of esmolol in such settings.

Keywords: Anaesthesia, Laryngoscopy endotracheal intubation, Cardiovascular response, Attenuation, Esmolol, Efficacy.

Introduction

Circulatory reflex responses[1] to direct laryngoscopy and tracheal intubation, and circulatory hazards subsequent to endotracheal anesthesia have been increasingly appreciated besides other sequelae.[2] Reflex nature of these hazards or direct effect due to drugs have been mentioned as etiological factors.[3] The main cardiovascular responses to laryngoscopy with tracheal intubation or extubation include tachycardia, increased blood pressure, myocardial oxygen demand and extra systoles,[4] which are probably due to an increase in plasma catecholamine levels in response to this stimulus.[5] However, once the stimulus is over, these transitory responses revert back to basal level.[6]

The clinical implications during anesthesia include myocardial ischemia, cerebral hemorrhage,[7] left ventricular failure[8] etc., and have been attributed to a sudden rise in blood pressure, not of significance in normotensive, which can be detrimental or even fatal in borderline hypertensive coronary and cerebral arterial diseases.

Considering the undesirable cardiovascular responses to laryngoscopy and endotracheal intubation, a lot of research has been done into devising a method of attenuating these responses. These include topical anesthesia of oropharynx, larynx and trachea,[9] intravenous lignocaine[9] droperidol,[10] use of high dose fentanyl,[11] beta-adrenergic receptor blockers, intravenous administration of nitroglycerine,[12] establishment of adequate depth of anesthesia and quick atraumatic laryngoscopy, nifedipine,[13] nerve block (lingual, glossopharyngeal and vagal blocks), etc. Recent years due to an increase in the number of patients with underlying cardiac or coronary artery disease attending the hospitals for elective or emergency, cardiac or non-cardiac surgery, anesthesiologists have been challenged to investigate newer means to attenuate reflex cardiovascular responses to laryngoscopy and intubation which may possibly lead to cerebrovascular accidents, myocardial ischaemia, convulsions and pulmonary oedema in susceptible individuals.[14]

β–Blockade has been used to attenuate the cardiovascular stress responses to laryngoscopy and tracheal intubation, but the role remained limited because of relatively long duration of action with potential of adverse effects that may not be rapidly reversible in these acute care settings and also the rebound effect on withdrawal of the β–blocker.[15] This led to the discovery of Esmolol Hydrochloride, a short acting intravenous nonselective β-blocker.[16,17] In acute care settings, such as laryngoscopy and tracheal intubation, esmolol HCL has advantage of rapid onset of action (distribution t 1/2- 2.5 minute), short duration of action (elimination t ½- 9.5 minutes) with no rebound phenomenon on withdrawal and rapid termination of adverse effect in majority by merely stopping the drug.[10,18,19]

Esmolol HCl has been used in single intravenous bolus dose with success to attenuate cardiovascular responses to laryngoscopy and tracheal intubation.[20-25]

Aims and Objectives

1. To assess the role of esmolol hydrochloride in single intravenous dose in attenuating cardiovascular responses of laryngoscopy and endotracheal intubation.
2. To compare the efficacy and safety of esmolol hydrochloride in single intravenous dose in different dose groups in prevention of cardiovascular response of laryngoscopy and endotracheal intubation.

Materials and Methods

Departmental and College committee ethical approval sought, informed &written consent was taken from all patients. It is double blind prospective randomized study. During the study period ASA I and II normotensive patients that had undergone elective general anesthesia management for various surgical interventions, of either sex, in age group of 20 to 60 years, were taken for study randomly by concealment or masking method. Patients underwent complete preanesthetic checkup and routine investigation and were allotted codes, collected by blind investigator who prepared coded 20 ml syringes of either drug or saline. Another blind investigator injected drug or saline at given time and collecting coded syringes to match later after the study period, to divide all 75 patients in 3 groups for statistical analyses. Observation were made by the 3rd blind observer, not knowing of any group of what is getting injected to the given patient.

Exclusion Criteria included heart Rate <60 beats/minute, A-V Block (>than Ist degree), history of congestive heart failure (CHF), Bronchospasm, Asthma, peripheral vascular disease (PVD), Sick sinus syndrome, anticipated difficult airway and intubation time >30 seconds. The patients in the study were randomly divided in three group of twenty-five patients each, randomly and given codes each to which observer and the investigator were blinded. Blinded investigator was given the injection of either saline or drug, as 20 ml coded syringes. Drug or saline was injected by the blind observer.

Group I: Served as control and no drug was administered before intubation. Normal saline was given instead.

Group II: Patients received intravenous esmolol 1mg /kg body weight in dilution of 5mg/ml given after administration of thiopental and before inj. Succinylcholine.

Group III: Patients received intravenous esmolol in dose of 1.5mg/kg body weight diluted to make volume 5 mg/ml given after inj. Thiopental and before inj. Succinylcholine.

Test drug or saline was given slowly in 20 seconds. Completion of injection of test drug/saline was taken as time '0' seconds.

Test Drug- Inj. Eesmolol hydrochloride 100 mg vial

Anesthesia Technique

Patient brought to the OT. A suitable intravenous (I.V.) line was set up, vital parameters were recorded by the second observer throughout the perioperative period. Patients were premedicated with Inj. diazepam I.V. in dose of 0.1 mg/kg body weight. No anticholinergic was given. Patients were preoxygenated with 100% O2, anesthesia induced with thiopental 2.5% in a dose of 5mg/kg body weight. This was followed by test drug (or normal saline in control group) which was injected IV over 20 seconds. Inj succinylcholine 1.5mg/kg given to facilitate laryngoscopy and intubation. Laryngoscopy and oral endotracheal intubation were performed in the 1st attempt with an appropriate sized oral endotracheal tube at minute one following test drug (or normal saline). Maintenance of anesthesia done using oxygen: nitrous oxide, halothane and inj. Vecuronium as muscle relaxant. Standard ECG leads were monitored.

Heart rate (HR) and Blood pressure (BP) were recorded at pre induction, after the Inj. esmolol (or normal saline in control group, 0 second), pre intubation (1 minute after the test drug or normal saline), 30 sec. post intubation (1 minute 30 seconds after the test drug or normal saline), 1 minute post intubation (2 minute after the test drug or normal saline), 1 minute 30 seconds post intubation (2 minute 30 seconds after the test drug or saline), 2 minute post intubation (3 minute after the test drug or normal saline), and 3, 5, 8, 10 minutes post intubation (4, 6, 9 and 11 minute after the test drug or normal saline). Blood Pressure was reported as mean arterial pressure (MAP) given as MAP=Systolic +1/3 (Systolic-diastolic) intraoperatively; patients were observed for any undesirable side effects like bradycardia (pulse<60bpm), bronchospasm, hypotension (systolic BP<90 mmHg or MAP <80 mmHg and dysrhythmias). The observation were statistically analyzed to draw inferences.

Observations and Results

Age, Gender, Weight and Hb (Table 1): The age, sex ratio, mean weight and hemoglobin of patients in three groups were comparable (Table 1). Mean dose of esmolol were 54.70 mg and 79.93 mg in Group-II and III.

Changes in pulse of patients (Table 2, 3): Preinduction mean pulse rate were comparable statistically in all the group with no significant changes after test drug (P<.05). Peak post intubation increase in pulse rate at one minute in Group I returning to pre-induction level at 8 minute attenuated in Group-II and in Group-III.

(P< .001). This postintubation control of pulse rate by the test drug in Group II and III found to be of similar degree. In Group-I at 8 minute post intubation bradycardia (pulse rate <60bpm) occurred in 4%. At 3 minute postintubation 4% in Group-II and 12% in Group-III patients had bradycardia reversed merely by stopping halothane.

Changes of Mean Arterial Pressure (Table 2, 4): Pre induction MAP were comparable in group I,II and III with no significant changes after test rug(P<.05).

Peak postintubation control of MAP at 1 minute in Group-II was insignificant (P>.05), very significant in Group-III (P<.001). Thus in Group-II the test drug insufficient to attenuate increase in MAP postintubation significantly but the subsequent return of MAP to baseline was early (3min)as compare to control (5min). As compare to group-II control of postintubation increase in MAP was very significant in Group-III (P<0.01) except at 30 seconds where control were significant only (P<0.05) No patient had MAP<80 mmHg in any of test group.

Rate Pressure Product (RPP) Change (Table 5): Pre induction RPP were comparable amongst all groups. Post intubation peak rise in RPP at 1 minute in Group-I, controlled in Group-II and Group-III by the test drug very significantly (P<.01). Control of RPP in Group-III by the test drug was significant (P<0.05) as compare to Group II. RPP returned to pre induction value at 8 minute post intubation in Group I and 3 minutes post intubation in Group II (Table 2). In Group III no rise RPP seen postintubation.

Table 1: Age, gender, wight and Hb concentration of patients and mean does of esmolol used

S. No.	Distribution	Group		
		I	II	II
1	Age (Yrs) Mean +-	40.04 +- 10.84	44.79 +- 10.23	42.58 +-10.52
2	M/F* Ratio	14/11	14/11	11/11
3	Hb** gm% Mean +-	11.24 +-0.80	11.48 +-0.66	11.21 +-0.80
4	Weight Kg Mean +-	54.83 +-7.17	54.70 +-7.03	53.29 +-6.35
5	Esmolol (Mg) Mean +-SD	NIL	54.70 +-7.03	79.93 +-9.52

*Male/Female, ** Hemoglobin

Table 2: Changes in Mean pulse (M-Pulse), Mean arterial pressure (MAP) and Rate pressure product (RPP) from pre induction values

S. No.	Time	Group I			Group II			Group II		
		M-Pulse	MAP	RPP	M-Pulse	MAP	RPP	M-Pulse	MAP	RPP
1	Pre induction	0	0	0	0	0	0	0	0	0
2	After Test Drug	2.8	-1.12	178	2.24	-1.89	63	3.4	-2.56	121
3	Pre intubation	5.36	-1.25	420	0.16	2.11	-161	0	-2.66	-212
4	30 Sec Post intubation	23.68	8.19	3224	2.56	3.25	521	2.4	-0.26	209
5	1 Min Post intubation	31.38	10.83	4343	3	7.25	918	2.2	1.39	326
6	1 Min 30 Sec Post intubation	29.08	9.41	3944	1.88	6.75	737	1.04	1.02	182
7	2 Min Post intubation	26	6.91	3336	-0.12	3.76	286	-0.72	-0.53	-111
8	3 Min Post intubation	22.4	4.35	2685	-1.24	1.68	8	-2.52	-2.05	-407
9	5 Min Post intubation	13.64	0.51	1407	-2.84	-1.65	-415	-2.24	2.96	-453
10	8 Min Post intubation	1.76	-1.2	89	-2.36	-5.2	-335	4.96	-2.93	-669
11	10 Min Post intubation	-1.56	-2.19	-340	-2.6	-5.4	-449	1.96	-3.13	403

Min-Minute, Sec.-Seconds

Table 3: Mean pulse rate (M –Pulse) +-SD and p and t value between different groups

S. No.	Group	Pre-Induction	After test drug	Pre intubation	30 Sec Post induction	1 Min Post intubation	1 Min 30 Sec Post intubation	2 Min Post intubation	3 Min Post intubation	5 Min Post intubation	8 Min Post intubation	10 Min Post intubation
1	Group I	82.64	85.44	88	106.32	113.92	111.72	108.64	105.04	96.28	84.4	81.08
		7.32	7.09	7.41	6.5	6.05	6.3	6.29	7.23	7.99	8.30	6.5
2	Group II	80.12	82.36	80.28	82.68	83.12	82	80	78.88	77.28	77.76	77.52
		7.36	7.12	7.23	7.32	7.18	6.94	7.29	7.95	8.28	6.53	6.78
3	Group III	79.04	82.44	79.04	81.44	81.24	80.08	78.32	76.52	76.28	84.4	81
		6.46	6.48	6.27	6.39	7.08	7.64	7.73	8.75	6.67	6.3	5.88
p and t Values between different Groups												

S. No.	Group I &II	Pre-Induction	After test drug	Preintubation	30Sec Post induction	1Min Post intubation	1 Min 30 Sec Post intubation	2 Min Post intubation	3 Min Post intubation	5Min Post intubation	8 Min Post intubation	10 Min Post intubation
	Group I & II t p	1.20 >0.05	1.53 >0.05	3.73 <0.01	12.07 <0.001	16.40 <0.001	15.85 <0.001	14.87 >0.001	12.17 <0.001	8.26 <0.001	3.14 <0.01	1.90 <0.05
	Group I &III t p	1.84 >0.05	1.56 >0.05	4.62 <0.001	13.64 <0.001	17.55 <0.001	15.97 <0.001	15.21 >0.001	12.56 <0.001	9.36 <0.001	0.19 >0.05	0.05 >0.05
	Group II & III t p	0.54 >0.05	-0.04 >0.05	0.65 >0.05	0.64 >0.05	0.93 >0.05	0.93 >0.05	0.79 >0.05	1.01 >0.05	0.23 >0.05	-3.44 >0.05	-1.94 >0.05

p Values > 0.05 Significant p Values < 0.01 is very Significant. Min-Minute, Sec.-Seconds
Shows significant stabilization of pulse by pretreatment with Esmolol in Group II and III. The control is similar degree in both groups

Table 4: Mean arterial pressure (MAP) Changes (mmHg) +-SD p and t value between different groups

S. No.	Group	Pre-Induction	After test drug	Pre intubation	30 Sec Post induction	1 Min Post intubation	1 Min 30 Sec Post intubation	2 Min Post intubation	3 Min Post intubation	5 Min Post intubation	8 Min Post intubation	10 Min Post intubation
1	Group I	99.28	98.16	98.03	107.47	110.11	108.69	106.19	103.63	99.79	98.08	97.09
		6.67	6.77	6.44	6.52	6.44	6.31	6.49	6.62	7.19	7.50	6..03
2	Group II	100.00	98.11	97.89	103.25	107.52	106.75	103.76	10168	98.35	98.80	97.03
		6.97	6.92	6.65	7.45	7.06	6.54	6.49	6.97	6.53	6.69	5.93
3	Group III	97.93	97.17	95.0	97.45	99.12	98.75	97.20	95.68	94.77	94.80	94.60
		8.00	8.00	7.94	8.21	8.56	8.63	6.93	7.87	7.77	7.95	7.80
p and t Values between different Groups												
S.N	Group I &II	Pre-Induction	After test drug	Pre intubation	30 Sec Post induction	1Min Post intubation	1 Min30 Sec Post intubation	2 Min Post intubation	3 Min Post intubation	5 Min Post intubation	8 Min Post intubation	10 Min Post intubation
	Group I &II t p	-0.37 >0.05	0.03 >0.05	0.08 >0.05	2.13 >0.05	1.35 >0.05	1.07 >0.05	1.32 >0.05	1.01 >0.05	0.74 >0.05	-0.36 >0.05	-0.16 >0.05
	Group I & III t p	0.74 >0.05	1.42 >0.05	1.45 >0.05	4.77 <0.001	5.12 <0.001	4.65 <0.001	4.74 <0.001	3.86 <0.01	2.37 <0.05	1.50 >0.05	1.26 >0.05
	Group II & III t p	1.07 >0.05	1.39 >0.05	1.36 >0.05	2.61 <0.05	3.78 <0.01	3.69 <0.001	3.45 <0.01	2.85 <0.05	1.76 >0.05	1.93 >0.05	1.40 >0.05

p Values > 0.05 Significant p Values < 0.01 is very Significant. Min.-Minute Sec.-Seconds
Shows significant stabilization of MAP by pretreatment with esmolol in Group III. No control of MAP seen in Group II Except at 30seconds post intubation

Table 5: Mean rate pressure product changes +- SD and p and t value between different groups

S. No.	Group	Pre-Induction	After test drug	Pre intubation	30 Sec Post induction	1 Min Post intubation	1 Min 30 Sec Post intubation	2 Min Post intubation	3 Min Post intubation	5 Min Post intubation	8 Min Post intubation	10 Min Post intubation
1	Group I	8216	8395	8636	11440	12559	12161	11553	10902	9623	8306	7877
		1020	988	1019	1126	1173	1187	1155	1190	1195	1212	1010
2	Group II	8031	8095	7871	8552	8950	8769	8317	8040	7613	7696	7568
		1107	1033	990	1100	1079	1047	1080	1127	1095	951	988
3	Group III	7739	7860	7528	7949	8066	7921	7628	7333	7287	7071	7336
		1000	1009	970	994	1083	1115	1094	1112	936	951	904
p and t Values between different Groups												
S.No.	**Group I & II**	**Pre-Induction**	**After test drug**	**Pre intubation**	**30 Sec Post induction**	**1 Min Post intubation**	**1 Min 30 Sec Post intubation**	**2 Min Post intubation**	**3 Min Post intubation**	**5 Min Post intubation**	**8 Min Post intubation**	**10 Min Post intubation**
1	Group I & II t p	061 >0.05	1.05 >0.05	2.69 <0.05	9.17 <0.01	11.33 <0.01	10.72 <0.01	10.23 <0.01	8.73 <0.01	6.19 >0.05	1.98 >0.05	-0.26 >0.05
2	Group I & III t p	1.67 >0.05	1.89 >0.05	3.94 <0.01	11.62 <0.001	14.07 <0.01	13.02 <0.001	12.34 <0.001	10.96 <0.01	7.70 >0.05	4.01 >0.05	1.99 >0.05
3	Group II & III t p	098 >0.05	0.81 >0.05	1.24 >0.05	2.04 <0.05	2.89 <0.05	2.77 <0.05	2.24 <0.05	2.23 <0.05	1.14 <0.05	2.33 >0.05	086 >0.05

p Values > 0.05 Significant p Values < 0.01 is very Significant .Min.-Minute Sec-Second
Shows significant stabilization of RPP by esmolol in both Group II and III. Stabilisation of RPP in Group III is significant as compared to Group II.

Discussion

Sympathetic stimulation of the upper respiratory tract result in intense adrenergic response.[6,26] Mechanical stimulation of the respiratory tract increases nerve signals in cervical efferent sympathetic fibres.[26] This response are of transitory nature and reverting back to pre-stimulus levels once the stimulus in over.[6]

The clinical implication of reflex circulatory disturbances during anaesthesia in most patients are well tolerated but detrimental in hypertensives, ischemic heart disease,[27] and PIH. Sudden rise in blood pressure may cause myocardial ischemia, left ventricular failure,[28] cerebrovascular accidents and convulsions in pre-eclamptic patients. These stress responses to laryngoscopy and tracheal intubation blunted by β Blocker.[15]

In our study age of the patient varied between 20-60 year without any significant variation in cardiovascular responses of endotracheal intubation in terms of age (Table 1) due to difference in vagal tone.

The sex and mean weight ratio amongst the three groups was comparable (Table 1) with no effect on outcome of study.[12] Average weight of the patients was less in our studies compare to higher average weight of the patient in other studies.

Timings and doses of Esmolol HCL

In our study doses used were quite less are 1 mg/kg (Group II mean dose-54.70mg) and 1.5 mg/kg (Group III mean dose-79.93mg). Similar studies conducted by Oxorn et al,[21] Parnass et al,[22] Sheppard et al,[23] Yuan et al,[24] showed that much higher doses of esmolol were required to control the post intubation increase in pulse rate and MAP. These studies used 100 and 200 mg of Esmolol.[21,22,24] In these studies esmolol was injected before the injection thiopental and intubation was done at 2 minutes. In our study esmolol was injected after the inj thiopental and intubation was done between 1 and 1 ½ min. following test drug. Our timings not only allowed intubation time to coincide within peak effect of drug between 1 and 1 ½ min (distribution ½ life of esmolol is 2.5 minutes), but also allowed titration of doses of esmolol against side effect (Hypotension, Bradycardia) due to blunting of compensatory response following injection thiopental.

Pulse: The mean basal pulse rate were comparable in all 3 groups (Table 3). There was increase in pulse rate following inj. thiopental and inj. succinylcholine (82.64 to 88.00 bpm) in

Group I (Table 2) controlled very significantly in Group II ($P<0.01$) and highly significantly in Group –III ($P<0.001$) as compare to Group I without bradycardia (pulse <60 bpm). This shows that test drug allows the compensatory mechanism to act to some extent and allowed the dose of esmolol to be titrated against the side effect (Bradycardia and Hypotension). Post intubation peak increase pulse in Group I at one minute controlled in highly significant manner ($P<0.001$) by the test drug in Group-II and Group-III as compared to Group I. Control found to be of significantly similar degree ($P>0.05$) in both groups. Thus drug, in 1 mg/kg body weight and 1.5 mg/kg is highly effective in controlling post intubation increase in pulse rate in similar degree. Esmolol is highly effective in controlling post intubation increase in pulse rate and control exerted by both the dose group of drug found to be of similar degree.

Mean Arterial Pressure

Just before the intubation (One minute after the test drug) changes in mean arterial pressure were insignificant among different groups ($P>0.05$) i.e. drug did not cause any hypotension (Table 4). Post intubation peak rise in MAP was seen at one minute in group I and II and subsequent return to pre-induction level at 5 minutes in Group I, and at 3 minutes in Group II (Tables 2, 4). Thus esmolol in Group II was not sufficient to prevent increase in MAP but the subsequent return of MAP to baseline was early (Table 2). A dose of 1 mg/kg body weight is not found to be effective in controlling postintubation rise in MAP. In Group III esmolol was very effective ($P<0.001$) in controlling post intubation rise in MAP as compare to control and very significant as compare in Group II ($P<0.01$). At 30 seconds post intubation control were found to be significant ($P<0.05$) Table 4. No patient had hypotension in any of the test group. Thus the drug is found to be very effective in controlling postintubation increase in MAP in dose of 1.5 mg/kg body weight.

Rate Pressure Product (RPP)

Peak post intubation increase in RPP was seen at one minutes in Group I, subsequently returned to pre-induction level at 8 minute.

This postintubation rise in RPP was controlled in highly significant manner ($P<0.001$) in Group II and in Group III. Group III shows significant control ($P<0.05$) as compared to Group II (Table 5).

Thus the drug is effective in both doses groups in controlling the postintubation increase in RPP and the esmolol 1.5 mg/kg body weight found to be more effective than the esmolol 1 mg/kg body weight.

By maintaining the RPP to pre-intubation basal level esmolol keeps the cardiac O_2 consumption to pre-induction basal level attenuating adrenergic response. This is particularly beneficial in patient with IHD. Esmolol in doses of 1.5mg/kg bolus prior to induction of anesthesia is optimal for attenuating hemodynamic responses of intubation.

Intraoperative Complications

Except for the transient postintubation bradycardia (Pulse <60 bpm) at 3 minutes (4% of the patient in Group-II and 12% of the patient in Group III,) which reversed merely by stopping halothane no other complication was seen similar to other studies.[21-24] Side effect such as bronchospasm and hypotension (MAP<80 mmHg) was not seen. Intraoperative ECG monitoring showed none dysrhythmias among esmolol treated groups consistent with finding of Oxorn D et al, 1990.[21]

Conclusion

This study is unique in the sense that timing of administration allowed titration of doses with monitoring of side effects concludes that esmolol hydrochloride pretreatment mitigates rise in pulse mean arterial pressure, rate pressure product and ECG changes due to laryngoscopy and tracheal intubation. The drug acts differently in different doses. In dose of 1 mg/kg and 1.5 mg/kg drug effectively controlled post intubation rise in pulse. Dose required to control MAP is higher (1.5 mg/kg body weight) and without any serious side effects. Postintubation increase in rate pressure product (RPP) was attenuated in a significant manner in both the doses though control of RPP in doses of 1.5mgkg was significantly better. Thus, by controlling RPP esmolol effectively reduces the O_2 consumption by heart likely to prevent ischaemia[30] in patients with ischemic heart disease. No intraoperative complication such as hypotension or bronchospasm was seen. Transient bradycardia in some patients was reversed by reducing halothane and did not require any other treatment. It appears to be beyond doubt that esmolol[30] can be safely used to attenuate cardiovascular responses to laryngoscopy and intubation. However, the doses of the drug for the purpose is open to discussion. We recommend that a lower dose (1 mg/kg body weight) may be used where only control of pulse rate is required e.g. thyrotoxicosis. Where a more rigorous control is required over RPP a higher dose (1.5 mg/kg body weight) may be used, especially so because the drug is remarkably free of side effects even at this dose. This is consistent with finding reported by Miller et al that 1.5mg/kg is optimal to attenuate hemodynamic responses of intubation.[30] Considering safety profile its use is particularly handy in emergency set up. Further, the time at which the drug is administered also needs mention. In our view, the best time is just after induction with I.V. anesthesia so that dose can be titrated for any side effects and the time of intubation coincides with peak effect of the drug.

B -Blockers by atherosclerotic plaque stabilization and prevention of its perioperative rupture due to sympathoadrenal responses of laryngoscopy and intubation may give additional protection to patient with suspected asymptomatic coronary artery disease in busy clinical settings.

Conflict of Interest: None.

Abbreviations

t- ½ - Half life of a drug
ASA- American Society of Anesthesiology
HCL- Hydrochloride
MAP- Mean Arterial Pressure
RPP- Rate Pressure Product
CHF- Congestive Heart Failure
PVD- Peripheral Vascular Disease
OT- Operation Theatre
IV – Intravenous
HR- Heart Rate
BP- Blood Pressure
IHD- Ischaemic Heart Disease
Hb- Haemoglobin

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