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Anaesthesiology

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ATTENUATION OF HEMODYNAMIC RESPONSE TO ENDOTRACHEAL EXTUBATION AFTER GENERAL ANAESTHESIA: A PROSPECTIVE RANDOMISED CONTROLLED STUDY OF TWO DIFFERENT INTRAVENOUS DOSES OF VERAPAMIL

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ABSTRACT

Like intubation, tracheal extubation are associated with significant hemodynamic changes resulting in transient increase in blood pressure and heart rate. A double blind randomized controlled study was conducted on 90 patients of ASA 1 and 2 undergoing elective surgery to compare the attenuation of hemodynamic responses to tracheal extubation by using either verapamil 0.05 mg/kg or 0.1mg/kg with a control group receiving saline only. On conclusion of surgery, the study drug was administered using double blind technique and residual muscle paralysis was reversed. The patient was extubated after 2 minutes of administering the study drugs. The haemodynamic parametes in the form heart rate (HR), systolic arterial pressure (SAP), diastolic blood pressure(DBP) and mean arterial pressure (MAP) were recorded during and after tracheal extubation. The result showed that both the doses of intravenous verapamil attenuated the increases in haemodynamic parameters. The attenuation was greatest with verapamil 0.1 mg/ kg, while the alleviative effect of verapamil 0.05mg/ kg was inferior. These findings suggest that a bolus injection of verapamil 0.1 mg/kg given 2 min before tracheal extubation is a more effective in attenuating the cardiovascular changes associated with extubation than 0.05mg/kg dose.

INTRODUCTION

Tracheal extubation after conlusion of surgery produces similar haemodynamic changes as during tracheal intubation. The heart rate and blood pressure rises10% to30% of baseline values and lasting for approximately 5 to 15 minutes.[1]These transient responses are well tolerated by healthy subjects. These haemodynamic changes may be due to release of catecholamine during this stressful period.[2] These acute haemodynamic changes are detrimental in susceptible individuals and may results in dangerous arrhythmias, myocardial ischemia, acute cardiac failure, pulmonary edema[3-4]. It may prove fatal in ocular surgeries leading to dangerous increase in intraocular pressure[5], patients with cardiac disease[6] or intracranial surgeries with raised intracranial pressure or for aneurysm surgeries[7]or with essential hypertension who shows an exaggerated response to this stressful event. Many agents and techniques have been tried to prevent these haemodynamic responses such as extubation in deeper planes of anaesthesia[8-9] avoiding or reducing duration of laryngoscopy before extubation[10] use of laryngeal mask airway instead of endotracheal tube[11] topical airway anaesthesia with lignocaine[12-13] intra-cuff or intravenous lignocaine[14] pre-treatment with intravenous beta blockers[15-16] small doses of intravenous narcotics like fentanyl or remifentanil prior to extubation[17-19] intravenous calcium channel blockers[20-24] ,use of vasodilators like nitrates, prostaglandins and magnesium sulphate[25-27]Inspite of all above described approaches the reflexive response to laryngoscopy is not completely blunted. This is because there are many factors involed in this stress response such as surgical wound ,laryngotracheal mucosa irritation , recovery from deep plain of anesthesia and use of reversal agent.

Intravenous verapamil in dose of 0.05 mg/kg and 0.1 mg/kg was compared with placebo group to assess the ability of attenuating haemodynamic response to postoperative tracheal extubation in patient undergoing elective non-cardiac surgery

MATERIAL & METHODS

90 patients of ASA status 1 and 2 of age group 18 to 50 years weighing 45 to 70kg, scheduled for elective non-cardiac surgery and requiring general anaesthesia with endotracheal intubation was enrolled after approval from institutional ethical committee at Indira Gandhi Institute of Medical Sciences,Patna .After thorough preoperative checkup ,a written informed valid consent was obtained from all the patients enrolled in the study. The exclusion criteria included history of difficult airway, hypertension, bronchospasm, cardiac arrhythmias, any cardiac disorder,allergic to the study drugs and patient refusal. Patients were randomly allocated into Group 1 (saline 5ml) , Group II (IV verapamil 0.05 mg/kg) and Group III (IV verapamil 0.1 mg/kg) with 30 patients in each.Baseline heart rate (HR), Systolic Blood Pressure (SBP), mean arterial pressure (MAP) were recorded in operation theatre. Anaesthesia was induced and the trachea was intubated. The maintainance of anaesthesia was targeted to keep HR and SBP of ± 20% from base line.

After full recovery of anaesthesia, inj.Verapamil (0.05 mg/kg or 0.1 mg/kg made to volume of 5 ml with normal saline) or normal saline 5 ml was injected 2 minutes prior to the extubation and tracheal was extubated . Heart rate (HR), Systolic Blood Pressure (SBP), mean arterial pressure (MAP) were recorded at the time of extubation , 1 min., 3min. 5min. and 10 minutes after extubation. Analysis of variance (ANOVA) and Student paired-t- test was used for data analysis. P-value of < 0.05 was considered as statistically significant.

RESULT.

The groups were matched for their demographic data (Table 1). Preoperatively Mean heart rate(HR), mean systolic blood pressure(SBP) and mean arterial pressure(MAP) were comparable in all groups. Also no statistically significant difference was observed in any of the above parameters during intraoperative period. Post extubation at 1minute,however, a statistically significant decrease in Heart rate (HR), Systolic Blood Pressure (SBP), mean arterial pressure (MAP) were recorded in Group II when compared to Group 1 (Control) ($p<0.05$). Post extubation at 3, 5 and 10 minutes both Group II and Group III showed statistically significant decrease in mean HR ,SBP and MAP as compared to control group ($p<0.05$).The attenuatin of haemodynamic variables were more pronounced in Group III as compared to Group II ($p<0.05$)(Table II- Table IV).

Hypotension [SBP <80 mmHg], bradycardia [HR < 50 beats/min], Sinoatrial or atrioventricular block was not observed in any of patients during study .

Table 1: Epidemiological details of patients

	Group1(Control)	Group II	Group III
Age(mean/SD)	38.2±8.48	34.57±8.87	34.33±7.26
Gender			
Male	13(43.3%)	12(40%)	14(46.67%)
Female	17(56.7%)	18(60%)	16(53.33%)
Weight(Mean/SD)	49.78±7.35	52.04±5.83	50.90±5.54

Table II : Comparison of Heart Rate

Heart Rate (bpm)	Group 1 (Control)Mean±SD	Group II Mean±SD	Group III Mean±SD	*P Value	**Pair Wise		
					Group I vs Group II	Group I vs Group III	Group II vs Group III
Pre-op	88.57 ± 13.88	85.23 ± 44.22	86.13 ± 2.32	0.326	> 0.05	< 0.001	< 0.001
Baseline (at time of drug administration)	94.80 ± 10.71	95.57 ± 10.31	93.14 ± 8.91	0.416	<0.05	>0.05	<0.001
At time of Extubation	117.80 ± 12.98	115.26 ± 16.95	114.57 ± 14.96	0.620	<0.05	>0.05	<0.05
1 min	115.96 ± 15.89	107.57 ± 14.12	88.91± 9.58	< 0.001	< 0.001	< 0.001	< 0.001
3 min	108.96 ± 12.25	90.67 ± 12.91	84.36 ± 8.49	< 0.001	< 0.001	< 0.001	< 0.001
5 min	95.91 ± 9.83	84.27 ± 12.76	78.47 ± 9.61	< 0.001	< 0.001	< 0.001	< 0.001
10 min	92.53 ± 8.73	76.67 ± 11.61	72.21 ± 8.97	< 0.001	< 0.001	< 0.001	< 0.001

P-value determined by: *ANOVA ANALYSIS ** Student paired-t- test
P < 0.001-Highly Significant; P < 0.05- Significant; p>0.5 – not significant

Table III : Comparison of Systolic Blood Pressure

SBP (mmHg)	Group 1 (Control) Mean±SD	Group II Mean±SD	Group III Mean±SD	*P Value	**Pair Wise		
					Group I vs Group II	Group I vs Group III	Group II vs Group III
Pre-op	124.84 ± 3.05	127.40 ± 7.39	128.67 ± 6.52	0.437	< 0.001	> 0.05	< 0.001
Baseline (at time of drug administration)	126.26 ± 5.18	125.57 ± 6.77	125.70 ± 8.30	0.621	>0.05	<0.001	<0.05
At time of Extubation	140.53 ± 7.27	142.97 ± 7.35	144.23 ± 9.28	0.320	<0.05	<0.001	<0.001
1 min	132.23 ± 9.46	126.87 ± 7.86	120.87 ± 5.16	< 0.001	< 0.001	< 0.001	< 0.001
3 min	122.27 ± 7.12	117.73 ± 8.14	111.77 ± 6.06	< 0.001	< 0.001	< 0.001	< 0.001
5 min	120.77 ± 8.78	109.40 ± 6.54	104.07 ± 5.01	< 0.001	< 0.001	< 0.001	< 0.001
10 min	116.67 ± 7.43	101.80 ± 7.24	96.33 ± 6.18	< 0.001	< 0.001	< 0.001	< 0.001

P-value determined by: *ANOVA ANALYSIS ** Student paired-t- test
P < 0.001-Highly Significant; P < 0.05- Significant; p >0.05 not significant

Table IV : Comparison of Mean Arterial Pressure

MAP (mmHg)	Group 1 (Control) Mean±SD	Group II Mean±SD	Group III Mean±SD	*P Value	**Pair Wise		
					Group I vs Group II	Group I vs Group III	Group II vs Group III
Pre-op	97.03 ± 6.09	99.40 ± 7.49	100.83 ± 5.90	0.304	< 0.001	> 0.05	< 0.001
Baseline (at time of drug administration)	97.33 ± 7.33	99.33 ± 6.10	98.83 ± 3.94	0.794	>0.05	<0.001	<0.001
At time of Extubation	117.49 ± 5.20	111.26 ± 6.36	113.17 ± 3.72	0.320	<0.05	<0.001	<0.001
1 min	112.43 ± 5.01	101.27 ± 5.17	94.03 ± 3.39	< 0.001	< 0.001	< 0.001	< 0.001
3 min	102.13 ± 3.75	96.57 ± 5.16	86.23 ± 2.89	< 0.001	< 0.001	< 0.001	< 0.001
5 min	95.67 ± 5.77	87.53 ± 3.95	83.23 ± 3.60	< 0.001	< 0.001	< 0.001	< 0.001
10 min	92.63 ± 5.77	84.86 ± 4.02	81.53 ± 3.48	< 0.001	< 0.001	< 0.001	< 0.001

P-value determined by: *ANOVA analysis ** Student paired-t- test

P<0.001-Highly significant; p<0.05-significant; p>0.05-not signif

DISCUSSION

Both tracheal intubation and extubation results in similar hemodynamic stress to the patients as evident by tachycardia, hypertension and increased levels of circulating catecholamines. Hypertensive patients show exaggerated response both during tracheal intubation as well as extubation as compared to normotensive patients[2].An ischemic heart disease patient may develop a fresh episodes of myocardial ischemia and infarction [3-4] due elevated BP and HR resulting in increased cardiac workload and the oxygen demand of the myocardium.

Calcium channel blockers have been used in several studies to blunt haemodynamic response occurring during extubation[20-24] . IV verapamil has many favourable properties as rapid onset about 30 seconds and short duration of action up to 15 minutes,cardioselective, excellent negative chronotropic and negative ionotropic effect , cost effective and requiring a single bolus dose[28-30].However,IV Verapamil may precipitate synergistic bradycardia and hypotension[31-35] leading to congestive cardiac failure in susceptible patients. None of our patients,however, developed cardiac depression with the use of IV verapamil.

We conclude that iv verapamil in dose of 0.1 mg/kg given 2 minutes prior to extubation results more significant attenuation of haemodynamic parameters as compared to iv veapamil in dose of 0.05mg/kg. The result was significant at 1 minute with 0.1mg/kg dose and at 3 minutes with 0.05mg/kg dose after extubation. A study by Mikawa et al showed almost similar results[22] Our observations are also supported by many other studies advocating IV verapamil in dose of 0.1mg/kg is safe and effective in blunting haemodynamic response to extubation[21-22]. Hypotention, bradycardia , sinoatrial or atrioventricular block was not observed following iv verapamil in our patients as supported by various other studies[35] The negative dromotropic and ionotropic effects of iv verapamil may be offset reflex activation of the sympathetic nervous system[34].Delayed recovery from anaesthesia due to potentiating effects of neuromuscular blocking agents by verapamil[36] was not observed in our study which is supported by a study

conducted by Kanayaet al[37].

CONCLUSION

Intravenous bolus doses of verapamil 0.1 mg/kg is more effective than 0.05mg/kg bolus dose given 2 minutes prior to extubation in reducing pressor response.

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