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Effects of Pre-Treatment with Ephedrine on Intubating Conditions Following Priming with Rocuronium - A Double Blind Study.

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Abstract: *Since succinylcholine presents numerous adverse effects, there has been a continual search for a non-depolarizing muscle relaxant that can replicate the rapid onset of succinylcholine. Rocuronium is chosen since it is the non-depolarizing neuromuscular blocking drug in clinical use with the fastest onset time. Priming with Rocuronium improves the onset time when compared to a single intubating dose of Rocuronium. Onset of action of muscle relaxants is influenced by cardiac output and muscle blood flow. Ephedrine, which produces an increase in both cardiac output and muscle blood flow, reduces the onset time of Rocuronium. Priming combined with ephedrine may be superior to either technique used separately. The present study was aimed to evaluate the effects of ephedrine pre-treatment on intubating condition following priming with Rocuronium.*

In this prospective double blind study 100 patients of either sex, belonging to ASA I or II, age 20-60 years, scheduled for surgery requiring endotracheal intubation, were randomly divided into two equal study groups of 50 patients each. Following pre-oxygenation, both groups had received priming dose of Rocuronium (0.04 mg/kg) 3 minutes before intubating dose of Rocuronium (0.6 mg/kg), group E (ephedrine group) had received ephedrine 70 µgm/kg with propofol in addition to priming dose of Rocuronium, whereas group NE (non-ephedrine) will receive saline + propofol with priming dose of Rocuronium. Intubating conditions were assessed as per COOPER'S Criteria (Jaw relaxation, Vocal cord position, Response to intubation) & a total score of intubation were considered as excellent=8-9, good= 6-7, poor = 3-5, bad = 0-2.

Keywords: *Ephedrine, Intubating conditions, Priming with Rocuronium*

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I. Introduction

Most intubations can be facilitated with 80%-90% neuromuscular block. The ideal relaxant for a rapid sequence induction should have a rapid onset of action and uniformly complete NM blockade in 1 minute. [(1)] Succinylcholine, a depolarizing neuromuscular blocking agent (NMBA) remains in common use for routine intubation in adults due to its rapid onset, profound depth of NM blockade & short duration of action. It is the NM blocker of choice when clinical conditions require emergency airway protection during rapid sequence induction of anaesthesia. The fast and reliable onset time of suxamethonium is the gold standard against which all other muscle relaxants are compared. However, it has several adverse effects like sinus bradycardia, hyperkalemia, increased intraocular pressure, increased intragastric pressure, myalgias, masseter spasm etc. [(2)] which precludes its use in all patients. Therefore, the search for a rapidly acting non-depolarising NMBA as an alternative to suxamethonium for rapid sequence intubation has been on for several years, which could provide equivalent or similar intubating conditions but be devoid of side effects of suxamethonium.

The onset time of NMBA is the period from anaesthesia induction to endotracheal intubation, a stage of anaesthesia during which the patients is exposed to the risk of hypoxia and pulmonary aspiration, and thus is an important & critical factor during rapid sequence intubation. Rocuronium has anonset of action morerapid than other clinically available non-depolarizing neuromuscular blocking agents and fills an important niche when succinylcholine may be contraindicated.[(3, 4)] . Andrews et al. [(5)] conducted a large sample randomized trial of Rocuroniumvs succinylcholine in rapid sequence intubation on 349 patients & found that Rocuronium 1.0 mg/kg given with propofol had clinically acceptable intubating conditions compared with succinylcholine (93.2% vs 97.1%) respectively. However, this large dose is likely to result in much longer duration of action.

The rate of onset of NM blockade in any one individual depends on the rate at which a pharmacologically effective concentration is achived in the biophase in this case; the NM junctional cleft,

which in turn is influenced by several factors such as the potency of drug, the dose administrated, prior use of a subparalytic (priming) dose and the cardiovascular status including cardiac output and muscle blood flow. [6, 7] While these techniques of administration can reduce the onset time, some can also lead to adverse effects. [8, 9]

The priming technique is one of the methods used to shorten the onset time of non-depolarising NM blockade. The priming principle basically refers to the administration of a small (usually and hopefully, subparalyzing) dose of a non-depolarising NM blocking drug several minutes before the intubating dose is given. The hypothesis is that priming dose increases the receptor occupancy in the synaptic cleft and subsequent 2nd dose of NMBA both shortens the onset and increases the degree of NM blockads needed for endotracheal intubation. [10, 11] It should be used carefully with special attention given to the possibility of hypoxia and aspiration of gastric contents in awake patients. [12] Although there is no consensus on the priming dose, it has been seen that 10% of ED 95 rarely produces measurable NM block effect and hence does not compromise patient's safety. [7]

The onset time of a NMBA is also determined by the speed with which the drug reach the NM junction , a factor that appears to be proportional to cardiac output and muscle blood flow. Ephedrine is a weak indirect & direct acting sympathominetic agent which produces venoconstriction more than arterial constriction thus improving venous return & increasing the cardiac output. The precise mechanism by which it decrease the onset is by enhanced delivery of the NMBA to the NM cleft by the increased blood flow to the muscles.[13, 14] Role of ephedrine in decreasing the onset of NM blockade has been investigated in various studies. Munoz et al. in 1997 [13] reported that small dose of ephedrine (70 µgm/kg) administered at induction reduced the onset time of rocuronium by 26% compared with placebo without adverse haemodynamic effects(72±19 secsvs 98±31 secs respectively) p=0.0006. Anthony et al. in 2001[15]evaluated the effect of pretreatment of ephedrine 70 µgm/kg iv on the onset of NM block with Rocuronium 0.6 mg/kg & observed that there was a significant improvement in onset time to complete block between ephedrine (84.15 secs) and placebo (100.52 secs). Tan et al. in 2002 [16] reported that there was a significantly higher proportion of intubating conditions graded as excellent in the propofol ephedrine group (84%) than in the propofol alone group (32%)(p=<0.0001).

It has been observed that ephedrine has a dose related effect on onset of NM blockade. Gopalakrishan et al. [17] used different dosages of ephedrine (70µgm, 100µgm &150µgm) to identify the ideal dose of ephedrine pre-treatment to shorten the onset of action of rocuronium. They concluded that 75 µgm/kg and 100 µgm/kg, both improved the intubating conditions during rapid sequence intubation but increasing the dose of ephedrine to 150 µgm/kg did not improve the intubating conditions. They concluded that ephedrine in excess dosage may produce vasoconstriction of blood vessels supplying laryngeal muscles, thus limiting the acess of the relaxant to its site of action. Kim et al. in 2003 [18] used ephedrine pre-treatment with vecuronium and found that ephedrine 70 µgm/kg decrease the onset time from 98 secs to 72 secs but 30 µgm/kg of ephedrine had poor intubating conditions.

Analysis of scientific data thus show that ephedrine does reduce the onset time of rocuronium and onset is also shortened by priming. Accordingly, Leykinet at. [19]hypothesised that priming combined with optimum dose of ephedrine may be superior to either technique used saperately. They evaluated 134 patients and reported that combination of ephedrine and priming had significantly (100%) improved clinical intubating conditions at 30 secs compared with priming(42%) or ephedrine (35%) when used separately.

We aim to study the synergistic effect of ephedrine pre-treatment and priming dose on intubating conditions following NMBA with rocuronium.

II. Materials And Methods

After the institutional ethics committee's approval, the present prospective double blind study was conducted in the department of Anaesthesia & critical care at Christian Medical College & Hospital, Ludhiana. A total of 100 ASA I & II patients of either sex in age group 20-60 years, scheduled for surgery under general anaesthesia requiring endotracheal intubation and muscle relaxation by NM blockade were included.

EXCLUSION CRITERIA:-

Patients with following problems were excluded from the study:-

1. Neuromuscular disease
2. Patients on drugs known to interact with the NM junction or ephedrine
3. Increased risk of pulmonary aspiration
4. Anticipated airway difficulties
5. Hypertensive and patients with Ischemic Heart Disease
6. History of egg allergy
7. Pregnant females

Group Allocation: - At this point patients were divided into two groups:-

100 patients involved in the study were randomly divided into two groups of 50 each in a double blind manner.

Group E-- (n=50) These patients had received ephedrine 70µgm/kg diluted to 5 ml + Propofol 2.5 mg/kg, 2 minutes and 30 secs after priming with Rocuroniumi.e group E received ephedrine pre-treatment in addition to priming dose of Rocuronium.

Group NE-- (n=50) For blinding purpose these patients had received equivalent volume i.e 5 ml of saline with Propofol 2.5mg/kg, 2 minutes and 30 secs after priming with Rocuroniumi.e group NE had not given ephedrine and had received only priming dose of Rocuronium.

The drug (ephedrine + propofol / saline + propofol) will be injected over a period of 30 secs.

After a total of 3 minutes of priming dose of Rocuronium, intubating dose of Rocuronium 0.6 mg/kg was given in 5 secs to facilitate endotracheal intubation. Endotracheal intubation was attempted at 30 secs after intubating dose of Rocuronium. Intubation and assessment of intubating conditions was performed by anaesthetist with at least two years of experience who was blinded to the group allocation and not involved in drug administration.

Assessmentof successful intubation were done as per **Cooper's criteria**[(20)]

A total score of intubating conditions were considered as excellent = 8-9, good = 6-7, poor = 3-5, bad = 0-2

Endotracheal intubation will be considered successful if performed within 20 secs interval. If the intubation cannot be performed within 20 secs interval after intubation dose of Rocuronium, then the case will be labelled as failure and the reasons for the same will be recorded. These patients will then be intubated according to the requirement of the case.After intubation, anaesthesia will be maintained with a mixture of N2O:O2::70:30, Isoflurane and fentanyl/morphine.

At the end of the study, the observations and results were tabulated & statistically analysed by Chi-square test and ANOVA test.

III. Result And Analysis

For the present study, one hundred ASA I/II patients of either sex in age group of 20 to 60 years admitted to Christian Medical College Hospital scheduled to undergo surgery under general anaesthesia requiring endotrachial tube intubation and muscle relaxation were selected. They were randomly allocated into two groups.

Group E (n=50) – priming +ephedrine pretreatment.

Group NE (n=50) – priming only & no ephedrine pretreatment.

The mean age in group E was 31.24±9.69 and in NE group was 35.32±11.70, with p-value 0.061 i.e.>0.05 level. (Table 1)

Distribution of males and females in E groups and in NE group was comparable and the difference was statistically not significant (p-value.>0.05). (Table 2)

The distribution of ASA groups in the two groups was essentially similar and statistically comparable with p>1.000. (Table 3)

We analyzed the heart rate at various time intervals i.e. (intragroup comparison showed that) and compared the E and NE group to find out statistical significance. In E group, there was tendency towards tachycardia of statistical significance at all timings upto 5 min compared to the basal value (In NE group increase at one min 93.88 ± 11.96). In NE group, increase in heart rate was seen just prior to intubation and till 3 min after intubation which was of statistical significance. However in NE group, there was no significant increase in heart rate at 4 and 5 min after intubation (Table 4).

In E group, maximum increase in heart rate had increased by +20.42 above the baseline at 1 min after intubation and in NE group, maximum increase in heart rate had increased by + 9.86 above the baseline at 1 min after intubation (Table 5).

In both the groups the, systolic blood pressure was observed from priming onwards till 5 min after intubation. Before intubation, the systolic blood pressure remained unchanged, in both the E and NE groups. However, after intubation, in E group systolic blood pressure increased and in NE group decreased from basal value. In E group, there was increase seen in systolic blood pressure compared to basal value at the time of just prior to intubation and the trend of increase continued till 5 min after intubation which had statistical significance. In NE group, there was a statistical significant decrease in systolic blood pressure compared to basal value seen from the time of just prior to intubation till 5 min after intubation. (Table no. 6)

In E group the maximum increase in systolic blood pressure (+15.56) from baseline was seen at 1 min after intubation. For NE group, there was decrease in systolic blood pressure compared to baseline and the maximum decrease was seen at 1 min after intubation (-23.28). (Table 7)

. In E group diastolic blood pressure increased and in NE group decreased from basal value. In E group there was increase seen in diastolic blood pressure compared to basal value at the time of just prior to intubation and the trend of increase continued till 5 min after intubation which had statistical significance. In NE group,

there was a statistically significant decrease in diastolic blood pressure compared to basal value seen from time of just prior to intubation till 5 min after intubation. (Table no. 8)

In E group, the maximum increase in diastolic blood pressure from baseline was (+11.32) seen at 1 min after intubation. For NE group, there was decrease in diastolic blood pressure compared to baseline which was maximally seen at 1 min after intubation (-13.2). (Table 9)

For both E and NE groups, the arterial oxygen saturation never fall below the baseline value and it was never less than 98% in any of the patients. The values of SpO2 for all patients were always adequate for tissue oxygenation and the intragroup comparison showed no difference from baseline value in both E and NE groups (Table - 10).

On intergroup comparison, the difference in SpO2 level between the two groups was statistically not significant at any time of observation during the study. (Table-11).

On statistical evaluation of jaw relaxation scores between groups E and NE there was no significant difference. (Table- 12)

Between the two groups clinically more no. of patients i.e. 92% achieved grade 3(open vocal cord) in E group compared with 76% patients having achieved grade 3(open vocal cord) in NE group but on statistical analysis the difference was not found significant (Table 13) ($p=0.054$)

On intergroup comparative evaluation, there were 58% patients in group NE who had 0 grade compared with only 10% patients in group E and the difference was statistically significant ($p<0.0001$). When number of patients achieving the best grade i.e. grade 3 were analysed ; we found that in NE group only 16% patients achieved grade 3 in response to intubation compared with 64% patients having grade 3 . In E group, and the difference between the groups for patients response to intubation was statistically significant in favour of ephedrine group ($p<0.0001$). (Table 14)

There were more no. of patients in group NE compared with group E who had good intubating conditions, 48% Vs 18% respectively. ($p<0.00142$)

When grade for excellent intubating conditions were analysed, we observed that intubating conditions were far superior in group E compared with NE, as in group E much higher % patients (70%) who achieved excellent grade compared with only 10% patient in group NE($p<0.001$).(Table 15)

No any significant side effects were seen in any of the E or NE group patients at any time interval. (Table-16)

IV. Discussion

Rocuronium (ORG 9426) is a new aminosteroid, monoquarternary, intermediate acting, non-depolarising muscle relaxant. It is stable in aqueous solution and is structurally related to vecuronium. Rocuronium has faster onset with no active metabolites. It is shown to have minimal cardiovascular activity & results in stable haemodynamic profile in clinical practice. [21] It has pharmacodynamic profile that satisfies for the search of NDMR that has potential to replace suxamethonium in clinical practice. However, scientific evidence from various studies have shown that rocuronium may be close to suxamethonium for intubating conditions but still not as fast as suxamethonium. [22, 23] Cooper et al [20] found in his study that the average time for the onset of block following Org9426 was 88.9sec and that for succinylcholine 60.4sec.The degree of block using a form displacement transducer & a neuromuscular function analyzer was about 89% and 98%, respectively, at 60 and 90sec after Org 9426.

Onset times similar to those of succinylcholine could only be obtained with high doses of rocuronium 0.9-1.2 mg/kg. [24, 25, 26] However, Hammerling T.M. et al [23] found that a megadose of the relaxant resulted in unduly prolonged duration of action from 45 min to 74 min. Therefore, rocuronium in large doses may not be suitable for shorter surgical procedures.

Optimal priming dose should hasten the onset of neuromuscular block without producing any side effects and priming dose of 10% of the standard intubation dose and a priming interval of three to four minutes have been recommended as safe and effective. Griffith et al [27] In our study we had used 0.04 mg/kg of rocuronium as priming dose, and did not come across any adverse effects viz. ptosis, blurred vision, respiratory difficulty/depression, hypoxia restlessness during priming interval of 3 min and there was no fall in spo_2 seen during priming interval. Donati F [6] suggested that subjective muscle weakness is a distressing symptom, frequently observed in awake patients, during the priming interval and the incidence of muscle weakness could be minimized with the use of a priming dose equivalent to 10% of the ED, of a neuromuscular blocking drug. Leykin et al[19] used priming dose of 0.04 mg/kg of rocuronium following 3 min later by an intubating dose of 0.4 mg/kg of rocuronium and they also did not report any signs of patient discomfort, palpebral ptosis, blurred vision, respiratory difficulty or hypoxia and arrhythmias during the priming interval. Kopman and colleagues [7] in their analysis of safety and timing of priming dose used a higher priming dose (0.06 mg/kg) which produced a measurable neuromuscular depression in 1 in 50 patients.

Hemmerling et al [23] compared two intubating doses of rocuronium 0.6 and 0.9 mg/kg and found that the onset time could be hastened by increasing the dose. Magorian et al [24] also found onset time similar to those

of succinylcholine could be obtained with doses of rocuronium 0.9-1.2 mg/kg. This is to be expected considering that there is a dose-related effect with rocuronium for both onset and peak effect at laryngeal muscles.

Gopalakrishan et al [17] also evaluated different dosages of ephedrine (75µgm, 100µgm &150µgm) to identify the ideal dose of ephedrine pre-treatment to shorten the onset of action of rocuronium. They concluded that 75 µgm/kg and 100 µgm/kg, both improved the intubating conditions but increasing the dose of ephedrine to 150 µgm/kg did not improve the intubating conditions.

Munoz et al [13] evaluated the effects of 70 µgm/kg of ephedrine at induction on onset time of rocuronium and found that the ephedrine reduced the onset time of rocuronium by 30 sec (72 ± 19 sec in ephedrine group Vs 98 ± 31 sec in placebo group.

The better intubating conditions and faster onset seen by administration of ephedrine during intubation followed by rocuronium in our study as well as other studies [13, 16, 19] demonstrate that it is most likely due to the effects of ephedrine resulting in an increased in cardiac output and tissue perfusion resulting in faster of delivery of rocuronium to the laryngeal and diaphragmatic muscles. [14,16] Studies using induction agents that maintain cardiac output and arterial pressure(i.e. etomidate and ketamine) have suggested that the use of these drugs was associated with faster onset of action and better intubating conditions with rocuronium. [28, 29]

It has been hypothesized that priming combined with ephedrine may prove superior in intubating condition to either technique used separately. Similar to our results Leykin et al [19] also found response to intubation was significantly better in Priming + ephedrine (100% patients) group compared to priming alone (46% patients) ($p<0.01$). They had achieved clinically acceptable intubating conditions in 100% patients compared to 88% patients in our study possibly because they had used 210 µgm/kg ephedrine whereas we had used 70 µgm/kg for our patients.

The rational for combining the priming principle with ephedrine comprises partial occupancy of the cholinergic receptors by the priming dose and acceleration by ephedrine of the residual receptor occupancy once the intubating dose of the neuromuscular blocker has been administered, hence further reducing the time for clinically acceptable intubating conditions.

V. Tables and Graphs

TABLE – 1: DISTRIBUTION OF THE SUBJECTS ACCORDING TO AGE

Code	N	Mean ± SD	Min	Max
Group E	50	31.24±9.69	20	60
Group NE	50	35.32±11.70	20	60
Total	100	33.28±10.88	20	60

P value: .061

TABLE – 2: DISTRIBUTION OF THE SUBJECTS ACCORDING TO SEX

Sex	Group E n (%)	Group NE n (%)
Female	25(50.0%)	19(38.0%)
Male	25(50.0%)	31(62.0%)
Total	50(100.0%)	50(100.0%)

P value: .227

TABLE – 3: DISTRIBUTION OF THE SUBJECTS ACCORDING TO ASA

ASA	Group E n (%)	Group NE n (%)
I	47(94.0%)	46(92.0%)
II	3(6.0%)	4(8.0%)
Total	50(100%)	50(100%)

Haemodynamics:- Results of the haemodynamic parameters that were observed are :-

TABLE-4: HEART RATE (INTRAGROUP)

	Group - E					Group - NE			
	N	**Mean ± SD**	**Min**	**Max**	**P value**	**Mean ± SD**	**Min**	**Max**	**P value**
Baseline	50	81.44±13.49	50	126	-	84.06±10.87	55	108	-
Just prior to priming	50	81.18±12.73	54	130	**1.000**	83.72±9.79	57	106	**1**
Just prior to intubation	50	100.08±12.68	76	153	**<.001****	93.78±8.90	72	121	**<.001****
1 min. after intubation	50	101.86±14.06	88	158	**<.001****	93.88±11.96	68	154	**<.001****
2 min. after intubation	50	100.88±15.83	86	163	**<.001****	93.78±14.58	66	163	**<.001****
3 min. after intubation	50	97.76±12.18	82	151	**<.001****	91.56±13.14	67	161	**.006* ***
4 min. after intubation	50	95.96±11.87	80	146	**<.001****	88.94±10.79	65	142	**0.151**
5 min. after intubation	50	92.62±9.80	79	132	**<.001****	86.38±8.71	64	121	**0.841**

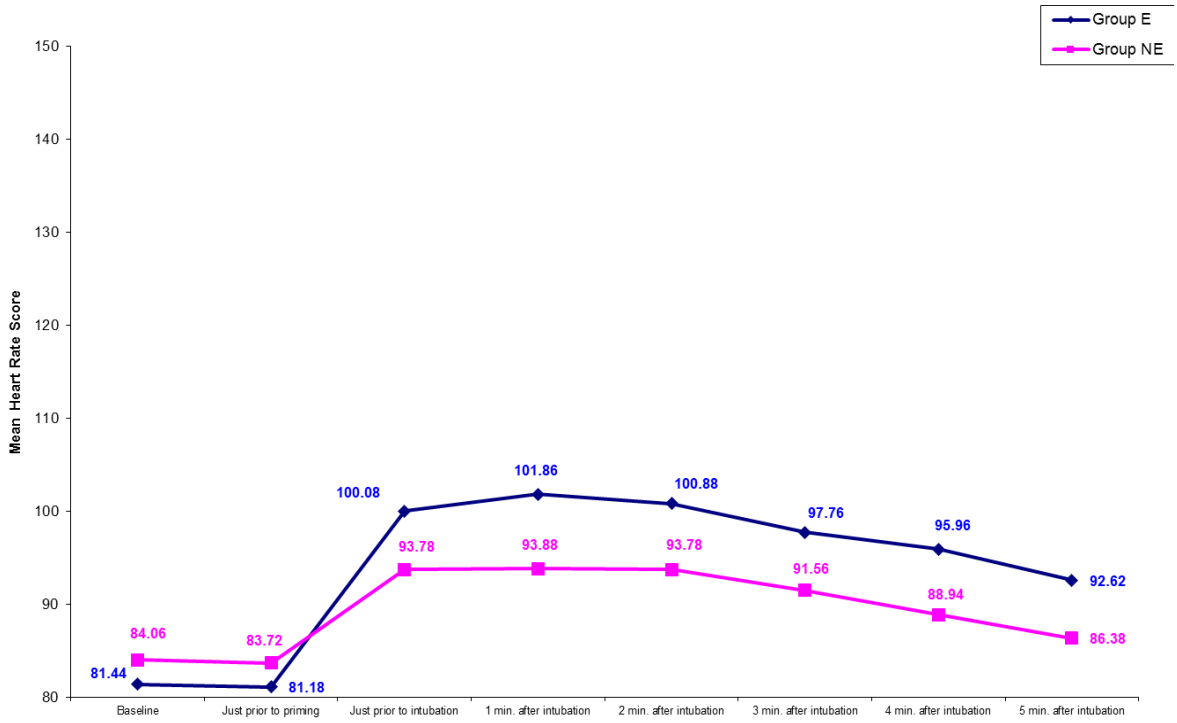

Fig. 1 HEART RATE (INTRAGROUP)

TABLE – 5: DIFFERENCE FROM BASE LINE & INTERGROUP COMPARISON FOR HEART RATE

Time	Groups	Difference from baseline	P value
Baseline	E	81.44	.288
	NE	84.06	
just prior to priming	E	-0.26	.266
	NE	-0.34	
just prior to intubation	E	+18.64	.005**
	NE	+9.72	
1 min. after intubation	E	+20.42	.003**
	NE	+9.86	
2 min. after intubation	E	+19.44	.022*
	NE	+9.72	
3 min. after intubation	E	+16.32	.016*
	NE	+7.5	
4 min. after intubation	E	+14.52	.003**
	NE	+4.88	
5 min. after intubation	E	+11.18	.001**
	NE	+2.32	

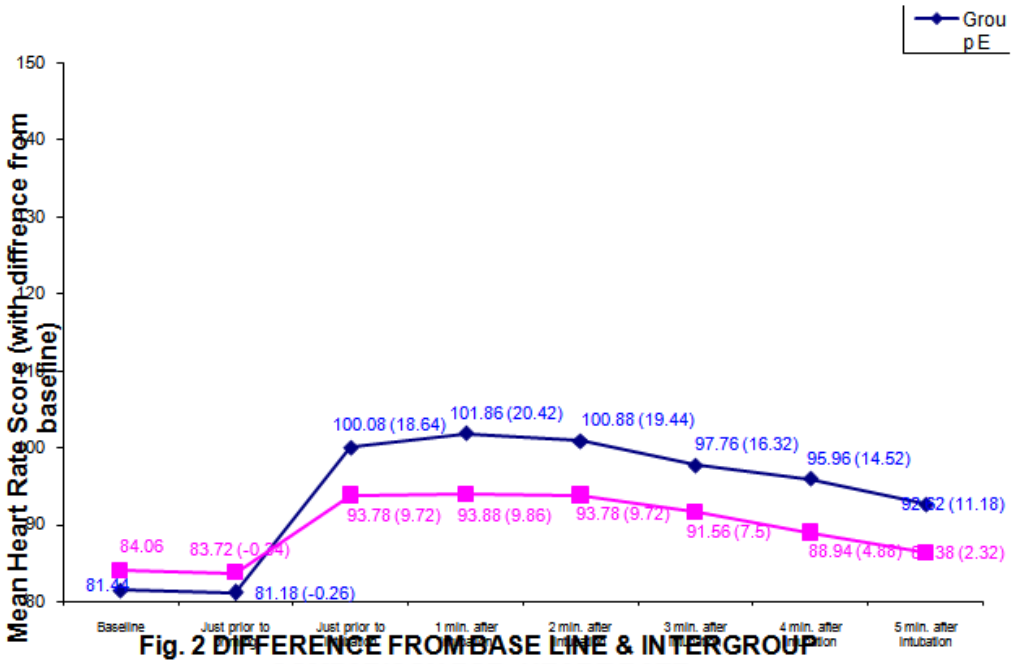

Fig. 2 DIFFERENCE FROM BASE LINE & INTERGROUP COMPARISON FOR HEART RATE

TABLE – 6: SYSTOLIC BLOOD PRESSURE (INTRAGROUP)

	Group - E					Group - NE			
	N	Mean ± SD	Min	Max	P value	Mean ± SD	Min	Max	P value
Baseline	50	125.12±12.37	100	150		128.00±12.01	110	150	
Just prior to priming	50	125.12±12.19	100	150	*1*	127.24±11.98	110	150	*.999*
Just prior to intubation	50	140.36±10.90	90	154	*<.001***	105.92±11.42	90	130	*<.001***
1 min. after intubation	50	140.68±7.26	120	152	*<.001***	104.72±10.80	80	130	*<.001***
2 min. after intubation	50	138.84±8.87	110	160	*<.001***	106.88±8.81	80	124	*<.001***
3 min. after intubation	50	136.52±7.72	120	154	*<.001***	108.00±7.63	90	128	*<.001***
4 min. after intubation	50	134.12±7.61	120	150	*<.001***	109.64±7.33	92	126	*<.001***
5 min. after intubation	50	131.12±9.00	100	146	*.013**	110.20±7.04	98	128	*<.001***

TABLE – 7: DIFFERENCE FROM BASE LINE & INTERGROUP COMPARISON FOR SYSTOLIC BLOOD PRESSURE

Time	Groups	Difference from baseline	P value
Baseline	E	125.12	*.240*
	NE	128.00	
just prior to priming	E	0	*.383*
	NE	-0.74	
just prior to intubation	E	+15.24	*<.001***
	NE	-22.08	
1 min. after intubation	E	+15.56	*<.001***
	NE	-23.28	
2 min. after intubation	E	+13.72	*<.001***
	NE	-21.21	
3 min. after intubation	E	+11.4	*<.001***
	NE	-20	
4 min. after intubation	E	+9	*<.001***
	NE	-18.36	
5 min. after intubation	E	+6	*<.001***
	NE	-17.8	

TABLE – 8: DIASTOLIC BLOOD PRESSURE (INTRAGROUP)

	Group - E					Group - NE			
	N	Mean ± SD	Min	Max	P value	Mean ± SD	Min	Max	P value
Baseline	50	80.28±8.61	70	100	-	82.24±8.63	70	100	-
Just prior to priming	50	80.04±8.64	68	100	*1*	81.68±8.67	68	100	*.999*
Just prior to intubation	50	91.48±6.61	60	100	*<.001***	69.56±7.76	54	90	*<.001***
1 min. after intubation	50	91.60±4.62	80	106	*<.001***	69.04±6.07	54	80	*<.001***
2 min. after intubation	50	90.14±4.35	80	100	*<.001***	70.56±6.15	50	84	*<.001***
3 min. after intubation	50	88.48±4.26	80	96	*<.001***	71.40±5.09	60	82	*<.001***
4 min. after intubation	50	86.76±4.94	70	96	*<.001***	71.88±5.02	60	86	*<.001***
5 min. after intubation	50	85.04±4.69	70	94	*.001***	73.00±5.27	60	84	*<.001***

TABLE – 9: DIFFERENCE FROM BASE LINE & INTERGROUP COMPARISON FOR DIASTOLIC BLOOD PRESSURE

	Group E				Group NE		
	N	Mean ± SD	Min	Max	Mean ± SD	Min	Max
Baseline	50	98.78±.864	96	100	98.78±.815	97	100
Just prior to priming	50	99.14±.405	98	100	99.12±.328	99	100
Just prior to intubation	50	99.16±.370	99	100	99.06±.240	99	100
1 min. after intubation	50	99.12±.328	99	100	99.06±.240	99	100
2 min. after intubation	50	99.08±.274	99	100	99.10±.303	99	100
3 min. after intubation	50	99.16±.370	99	100	99.10±.303	99	100
4 min. after intubation	50	99.14±.351	99	100	99.06±.240	99	100
5 min. after intubation	50	99.20±.404	99	100	99.04±.283	98	100

TABLE – 10: SPO_2

Time	Groups	Difference from baseline	P value
Baseline	E	80.28	*.258*
	NE	82.24	
just prior to priming	E	-0.24	*.346*
	NE	-0.56	
just prior to intubation	E	+11.2	*<.001***
	NE	-12.68	
1 min. after intubation	E	+11.32	*<.001***
	NE	-13.2	
2 min. after intubation	E	+9.86	*<.001***
	NE	-11.68	
3 min. after intubation	E	+8.2	*<.001***
	NE	-10.84	
4 min. after intubation	E	+6.48	*<.001***
	NE	-10.36	
5 min. after intubation	E	+4.76	*<.001***
	NE	-9.24	

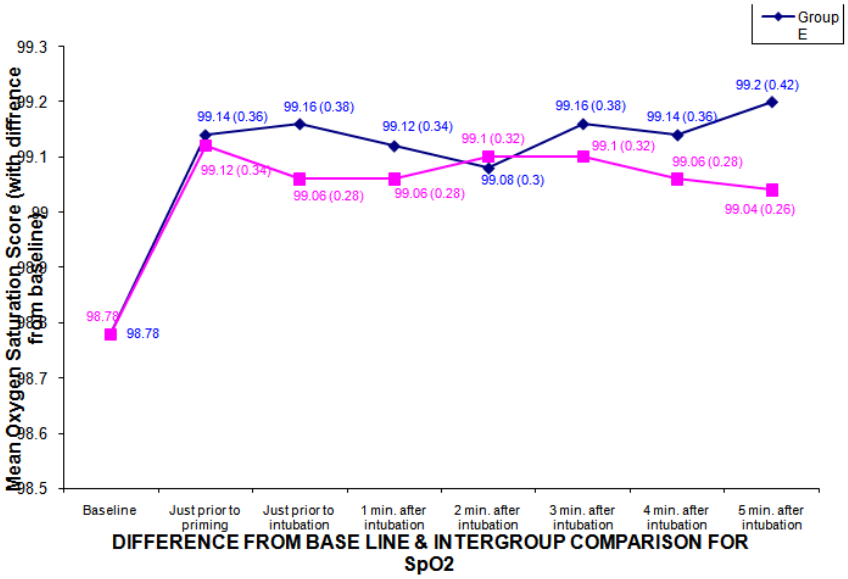

TABLE – 11: DIFFERENCE FROM BASE LINE & INTERGROUP COMPARISON FOR SPO_2

Time	Groups	Difference from baseline	P value
Baseline	E	98.78	*1.000*
	NE	98.78	
just prior to priming	E	+0.36	*.787*
	NE	+0.34	
just prior to intubation	E	+0.38	*.112*
	NE	+0.28	
1 min. after intubation	E	+0.34	*.299*
	NE	+0.28	
2 min. after intubation	E	+0.3	*.730*
	NE	+0.32	
3 min. after intubation	E	+0.38	*.377*
	NE	+0.32	
4 min. after intubation	E	+0.36	*.186*
	NE	+0.28	
5 min. after intubation	E	+0.42	*.024**
	NE	+0.26	

TABLE – 12: JAW RELAXATION SCORE (NO. & % OF PATIENTS)

	Jaw Relaxation score			
	0 (poor) n (%)	1 (minimal) n (%)	2 (moderate) n (%)	3 (good) n (%)
Group E	00(0%)	00(0%)	30(60%)	20(40%)
Group NE	00(0%)	3(6%)	27(54%)	20(40%)
p-value	Can't calculate	0.242	0.543	1.0

TABLE – 13: VOCAL CORD POSITION GRADE (NO. & % OF PATIENTS)

	Vocal Cord Position Grading			
	0 (closed) n (%)	1 (closing) n (%)	2 (moving) n (%)	3 (open) n (%)
Group E	00(0%)	00(0%)	04(8%)	46(92%)
Group NE	00(0%)	02(4%)	10(20%)	38(76%)
P-value	Can't calculate	.495	.084	.054

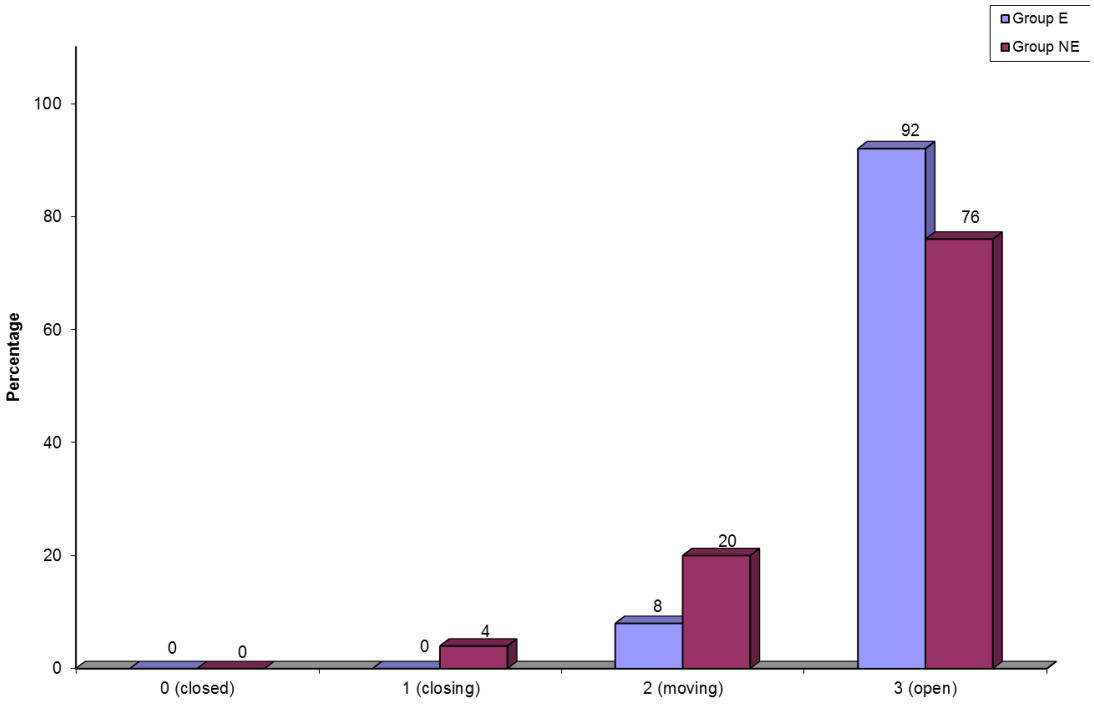

Fig. 10 VOCAL CORD POSITION GRADE

TABLE – 14: PATIENTS RESPONSE TO INTUBATION GRADE (NO. & % OF PATIENTS)

	0 (severe coughing and bucking) n (%)	1 (mild coughing) n (%)	2 (light diaphragmatic movement) n (%)	3 (none) n (%)
Group – E	5(10.0%)	5(10.0%)	8(16.0%)	32(64.0%)
Group - NE	29(58%)	11(22.0%)	2(4.0%)	8(16.0%)
p-value	<.0001*	.101	.0916	<.0001*

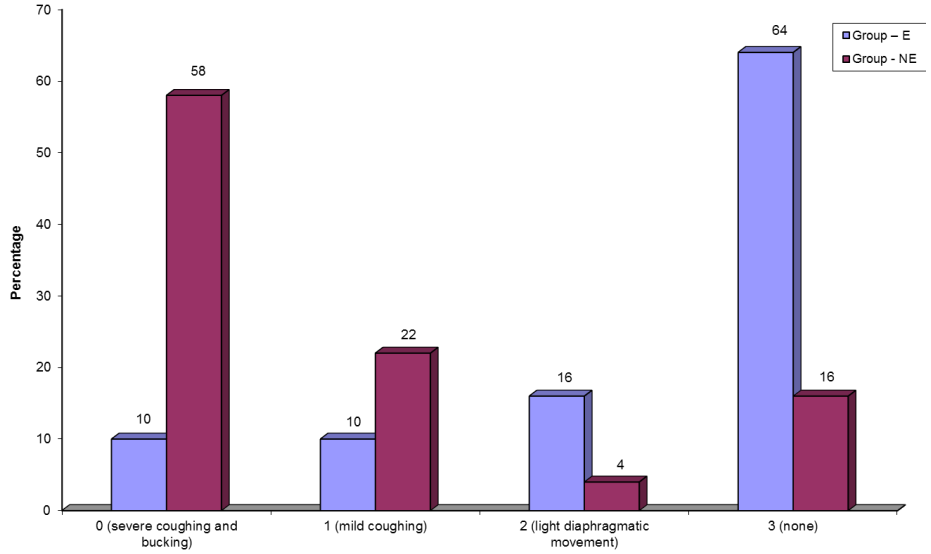

Fig. 11 PATIENTS RESPONSE TO INTUBATION GRADE

TABLE – 15: INTUBATING CONDITION ON TOTAL GRADE

Group	Excellent (8-9)	Good (6-7)	Poor (3-5)	Bad (0-2)
Group E n(%)	35(70%)	9(18.0%)	6(12.0%)	0 (0%)
Group NE n(%)	5(10.0%)	24(48.0%)	21(42.0)	0 (0%)
p-value	p < .001**	p < .00142**	p < .0007**	Can't calculate

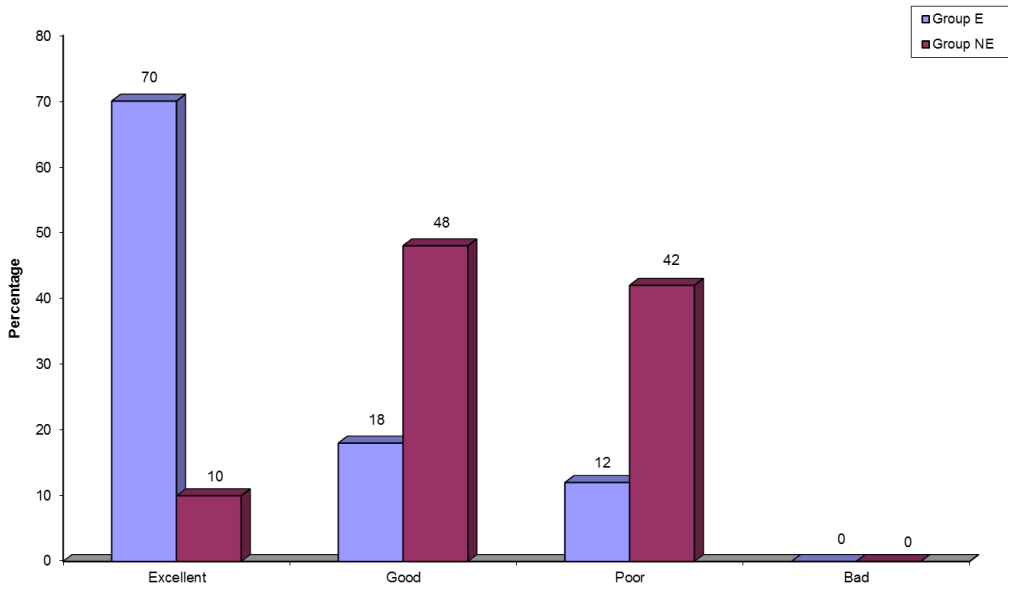

Fig. 12 INTUBATING CONDITION ON TOTAL GRADE

TABLE – 16: SIDE EFFECTS

	E- Group	NE- Group
Ptosis	Nil	Nil
Blurred vision	Nil	Nil
Respiratory difficulty/depression	Nil	Nil
Hypoxia	Nil	Nil
Restlessness	Nil	Nil

VI. Conclusion

In Present study we enrolled one hundred ASA I/II patients of either sex in age group of 20 to 60 years admitted to Christian Medical College Hospital scheduled to undergo surgery under general anaesthesia requiring endotrachial tube intubation and muscle relaxation.

From this study we conclude that

- The intubating conditions were satisfactory even for priming group but in comparison they were found to be superior in the study group i.e. priming + ephedrine group.
- The priming dose results in occupancy of the cholinergic receptors and ephedrine helps in acceleration of the residual receptor occupancy once the intubating dose of the neuromuscular blocker has been administered, hence further reducing the time for clinically acceptable intubating conditions.
- We recommend the use of priming + ephedrine with rocuronium to achieve good intubating conditions in time scale appropriate for rapid sequence induction especially when suxamethonium is clinically contraindicated.
- However, in view of the haemodynamic effects, caution should be exercised in the use of ephedrine in patients with hypertension and ischemic heart disease.

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