Original Research Article

Comparison of priming principle of two different doses of vecuronium during rapid - sequence induction of anaesthesia

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Abstract

Background: Rapid sequence induction and tracheal intubation with two different priming doses of vecuronium. The purpose of this study was to determine whether prior administration of a small, sub-paralytic dose of nondepolarizing muscle relaxant, vecuronium, would have a better intubating condition than a single bolus dose when vecuronium was used as the muscle relaxant during rapid sequence induction and tracheal intubation. **Materials and Methods:**A total of 50 patients randomly of either sex were allocated into 2 groups 25 patients each (ASA class I or II) were involved in this study. All the patients were premeditated with tab alprazolam 0.5mg and tab ranitidine 150mg given orally on the previous night of surgery. On the day of surgery inj. glycopyrolate 0.2mg was given intramuscularly 45 minutes before surgery. **Group A** patients received fentanyl 1 micrograms/kg and Priming dose of **0.01mg/kg** IV vecuronium and **Group B** patients received fentanyl 1 micrograms/kg and Priming dose of **0.02mg/kg** IV vecuronium. In both groups three minutes after the priming dose, patient induced with thiopentone sodium 5mg/kg IV and Vecuronium 0.1mg/kg IV were given and after 30 seconds patients were intubated. Patients were compared; the symptoms developed after priming dose, intubating conditions were assessed and graded clinically using the criteria as described by Fahey et al, cardiovascular and haemodynamic changes during priming interval (3 minutes) and up to 30 minutes after intubation.**Results:** In group B after priming dose of vecuronium 0.02mg/kg, out of 25 patients, 3 patients had symptoms and in group A after priming dose of vecuronium 0.01mg/kg, out of 25, 2 patients had symptoms and both group of patients were clinically stable. The result is not significant at $p<0.05$. In group B patients, intubating conditions were excellent (score1) in 64% cases, good (score 2) in 36 % cases patients and no cases comes under score 3 and 4 .In group A patients, intubating conditions were excellent (score1) in 8% cases, good (score 2) in 88 % cases, fair (score3) in 4% cases and no case comes under score 4. The $P<0.001$ was highly significant, thus it was observed that group B showed a significant rapid intubating conditions than group A. **Conclusions:** In conclusion, we recommend that, a priming dose of 0.02mg/kg of vecuronium along with inj. fentanyl 1 micrograms/kg intravenous, with 3 minutes of priming interval and induced with inj. Thiopentone sodium intravenous of 5mg/kg and remaining dose of 0.1mg/kg of vecuronium, after 30 seconds for the advantages of achieving the intubating conditions as an alternative technique for rapid sequence induction of anaesthesia.

Keywords: Neuromuscular relaxant: Vecuronium; priming dose; intubation.

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The use of muscle relaxants has become a vitally important aspect of modern anaesthesia practice. The introduction of muscle relaxants in anaesthesia in 1942 Griffith and Johnson was a major step forward since any desired degree of muscle relaxation could now be instituted and relaxation became independent of the depth of anaesthesia. The use of muscle relaxants to facilitate intubation was pioneered by Bourne. Muscle relaxants allowed surgery to be carried out on elderly and debilitated patients and simplified anaesthesia for surgical

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interventions in the chest and the abdomen. However, new problems also occur, such as awareness and recollection of intra-operative events due to inadequate anaesthesia and serious postoperative complications as a consequence of inadequate breathing capacity due to residual curarization. Initially, only long acting neuromuscular blocking agents were available, characterized by a slow offset of block and reversal agents were introduced into clinical practice once the problem of residual curarization was recognized. Succinylcholine, introduced by Thesleff and Foldes *et al.* 1952 gave a new dimension to the anaesthesia practice by providing intense neuromuscular blockade of very rapid onset and ultra short duration, thereby greatly easing the maneuver of tracheal intubation. This agent is still widely used to facilitate intubation despite its many side effects varying in seriousness from masseter spasm, patient discomfort due to postoperative muscle pain, hyperkalemia after burns, increases intraocular, intragastric, intracranial pressure and malignant hyperthermia. Also with repetitive doses a phase 2 blocks could develop, resulting in a neuromuscular blocking profile similar to that of existing long acting neuromuscular blocking agent. In 1957, Foldes summarized, for the first time the required characteristics of the ideal neuromuscular blocking drug. He suggested, a short acting agent, the fate of which in the body should not be affected by pathological changes. This description, translated into pharmacokinetic terminology, emphasizes the importance of rapid, organ function independent and plasma clearance. In an effort to develop a neuromuscular blocking agent who fulfilled nearly all the criteria of an ideal muscle relaxant vecuronium bromide was introduced by Dr.Savage of organon Technical laboratories in 1980. It is an aminosteriod intermediate acting neuromuscular relaxant produced by demethylation of pancuronium. This compound, according to the classification of Sarvarese and Kitz was a neuromuscular blocking agent with an intermediate duration of action and, in particular, with a faster rate of recovery. However, the onset of action more or less governing the time to intubation was still slow to allow rapid sequence induction and early intubation, particularly in patients prone to aspiration. In exploring various possibilities for facilitation of rapid tracheal intubation it occurred that this may be accomplished by the administration of a nondepolarizing muscle relaxants in divided doses. It was assumed that it would be feasible to select a priming dose of muscle relaxant that would be just large enough to cause moderate inhibition of neuromuscular transmission, indicating greater than 75% occupancy of choline receptors, without causing unpleasant symptoms in awake patients. Tracheal intubation the could be performed rapidly after the injection of a second larger dose, that would increase receptor occupancy to about 90% necessary to profound neuromuscular block. In the present study, comparing the priming principle of two different dose of vecuronium during rapid -sequence induction of anaesthesia in various surgeries has been done.

MATERIALS AND METHOD

The study was conducted with the approval of Institutional Ethical committee and informed consent from each patient aged 18-60 years with physical status ASA I and II admitted in Rajah Muthiah Medical College and Hospital undergoing elective surgery under general anaesthesia. A total of 50 patients randomly of either sex were allocated into 2 groups (25 each). Group A patients received fentanyl 1 micrograms/kg and Priming dose of 0.01mg/kg IV vecuronium, three minutes after the priming dose, patient induced with thiopentone sodium 5mg/kg IV and vecuronium 0.1mg/kg IV were given and intubated. Group B patients received fentanyl 1 micrograms/kg and Priming dose of 0.02mg/kg IV vecuronium, three minutes after the priming dose, patient induced with thiopentone sodium 5mg/kg IV and Vecuronium 0.1mg/kg IV were given and intubated. All the patients were examined preoperatively to assess their medical history, physical status including weight, condition of cardiovascular, respiratory and central nervous system. The mandatory preoperative investigations done were hemoglobin, TLC, DLC, Platelet count, blood urea, serum creatinine, blood glucose, HIV, HbsAg, ecg and chest x-ray.All the patients were premeditated with tab alprazolam 0.5mg and ranitidine 150mg given orally on the previous night of surgery. On the day of surgery inj. glycopyrolate 0.2mg was given intramuscularly 45 minutes before surgery.On arrival to the operating room, a peripheral intravenous line was established with 18G or 20G intravenous canula using dextrose saline. Basal blood pressure, pulse rate, SpO_2 and ECG was measured.Patients were preoxygenated with 100% oxygen for 3 minutes. Group A patients were given Priming dose of 0.01m g/kg IV vecuronium bromide and fentanyl 1µg/kg. Group B patients were given Priming dose of 0.02mg/kg IV vecuronium bromide and fentanyl 1µg/kg and monitored for symptoms unable to protrude tongue, unable to open eyes, difficulty swallowing and difficulty breathing for 3 minutes and monitored pulse rate, blood pressure SPO2 and ECG changes. After 3 minutes of priming dose both the group of patients induced with thiopentone sodium 5mg/kg IV and followed by Vecuronium 0.1mg/kg IV were given and after 30 seconds patient were intubated**.** Endotracheal intubation was done under direct

laryngocopy with an adequate sized cuffed endotracheal tube. Intubating conditions were assessed. Pulse rate, blood pressure, SpO_2 and ECG changes were recorded.Anaesthesia was maintained with nitrous oxide and oxygen at a ratio of 66:33%. The patient heart rate, blood pressure, SpO_2 and ECG were monitored continuously. Pulse rate and blood pressure were recorded at intubation and 1, 5,10,15,20 and 30 minutes after intubation and at frequent intervals thereafter .Subsequent doses of relaxants were given at patients attempt to breathe. At the end of surgical procedure, the residual effect of the muscle relaxant was reversed with inj.Neostigmine 0.05mg/kg and inj. glycopyrolate 0.01mg/kg body weight. The patient were extubated after a satisfactory reversal and throat suction. All the patients were observed for an hour in recovery room

RESULTS

The groups were comparable with respect to age, weight and ASA physical status [Table 1,2,3]. The group B after priming dose of vecuronium 0.02mg/kg, patients out of 25, 3 patients had symptoms and in group A after priming dose of vecuronium 0.01mg/kg, out of 25, 2 patients had symptoms and both group of patients were clinically stable. The result is not significant at $p<0.05$[table 4].In group B patients, intubating conditions were excellent (score1) in 64% cases, good (score 2) in 36 % cases patients and no cases comes under score 3 and 4 .In group A patients, intubating conditions were excellent (score1) in 8% cases, good (score 2) in 88 % cases, fair (score3) in 4% cases and no case comes under score 4. The $P<0.001$ was highly significant, thus it was observed that group B showed a significant rapid intubating conditions than group A [table 5]. The cardiovascular and haemodynamic effects were minimal with the both groups. There was slightly increase in pulse rate, blood pressure in group B than group A when compared at different time intervals but this was found to be insignificant with $p>0.05$[table6,7]. The spo2 was maintained around 99-100% in both groups in different time interval and there was no fall in saturation in both groups.

Table 1:

Age groups (years)	Group A	GROUP B	P
18-31	11	12	0.7
32-45	10	8	0.5
46-60	4	5	0.7
Total	25	25	-
Range	18-58	18-58	-
Mean±SD	35.2±11.3	34.8±11.3	-

Table 2:

Sex	Group A	Group B	P
Male	15	14	0.78
Female	10	11	0.77

Table 3: ASA status

ASA	GROUP A		GROUP B		P
	NO	%	NO	%	
ASA I	15	60	17	68	0.6
ASAII	10	40	8	32	0.6

Table 4: Symptoms

Symptoms	Group A	Group B	P
Unable to protrude tongue	2	3	0.6
Unable to open eyelids	2	3	0.6
Difficulty in breathing	0	1	0.3
Difficulty in swallowing	0	1	0.3

Table 5: Intubating conditions

Intubation conditions	GROUP A		GROUP B	
	No of case	%	No of case	%
SCORE 0	2	8	16	64
SCORE 1	22	88	9	36
SCORE 2	1	4	-	-
SCORE 3	-	-	-	-
TOTAL	25	100	25	100
t value significance	24		24.2	
	P<0.0		P<0.001,HS	

Table 6: Mean pulse rate variations

Time of monitoring	Group A (beats/min)	Group B (beats/min)	T	P
Resting pulse rate before induction	83.3+5.9	81.7+5.9	0.96	0.17
0 min After priming dose	83.3±5.9	81.7±5.9	0.96	0.17
1 min after PD	85.5±5.9	85.5±6.1	0.06	0.94
2 min after PD	89.9±6.2	92.0±6.4	1.18	0.24
3 min after PD	95.4±5.4	96.6±7.0	0.68	0.50
Induction	95.4±5.4	96.6±7.0	0.68	0.50
0 min at intubation	98.9±6.9	100.7±80	0.89	0.39
1 min AI	102.4±7.2	105.2±7.4	1.36	0.18
5 min AI	98.9±6.0	102.0±8.3	1.53	0.13
10 min AI	95.4±5.4	96.6±7.0	0.68	0.50
15 min AI	89.9±6.2	92.0±6.4	1.18	0.24
20 min AI	85.5 ±5.9	85.5±6.1	0.06	0.94
30 min AI	83.3±5.9	81.7±5.9	0.96	0.17

Table 7: Variations in mean systolic and diasystolic blood pressure

	Systoic				Diasystoic			
Time interval	Group A (mmHg)	Group B (mmHg)	T	P	Group A (mmHg)	Group B (mmHg)	T	P
Resting	121.8+5.7	122.6+6.9	0.45	0.66	76.7±4.4	77.5±4.6	0.63	0.53
0 min After priming dose	121.8±5.7	122.6±6.9	0.45	0.66	76.7±4.4	77.5±4.6	0.63	0.53
1 min after PD	124.6 ±4.9	127±5.3	1.66	0.10	78.9±4.0	80.3±4.0	0.97	0.34
2 min after PD	124.6 ±4.9	127±5.3	1.66	0.10	78.9±4.0	80.3±4.0	0.97	0.34
3 min after PD	126.0±5.8	127±6.6	0.72	0.47	80.1±4.1	82.0±4.7	1.53	0.13
Induction	126.0±5.8	127±6.6	0.72	0.47	80.1±4.1	82.0±4.7	1.53	0.13
0min at intubation	130.6±6.1	132.7±7.6	1.08	0.29	83.4±4.7	85.2±4.6	1.37	0.18
1 min AI	135.9±5.1	138.0±7.3	1.20	0.24	90.2±5.1	91.4±3.4	1.00	0.32
5 min AI	133.1±4.4	135.0±6.4	1.29	0.20	87.1±4.4	88.2±3.6	0.97	0.34
10 min AI	130±5.8	132.0±6.3	1.18	0.24	83.3±4.2	84.6±4.8	1.00	0.32
15 min AI	124.6 ±4.9	127±5.3	1.66	0.10	78.9±4.0	80.3±4.0	0.97	0.34
20 min AI	121.0 ±4.5	122.3±6.4	0.87	0.39	77.0±4.6	77.7±4.2	0.56	0.58
30 min AI	121.0 ±4.5	122.3±6.4	0.87	0.39	77.0±4.6	77.7±4.2	0.56	0.58

In the present study, the symptoms were observed after the priming dose of vecuronium for 3minutes in two different doses.Four symptoms were observed such as unable to protrude the tongue, unable to open eyelids, difficulty in swallowing and difficulty in breathing in each group. In group A 2 patients were developed symptoms after priming dose. They complained of unable to open eyelids and tongue and no one had difficulty in swallowing and breathing. In group B 3 patients were developed symptoms after priming dose. 3 patients complained of unable to open eyelids and tongue and out of 3 only 1 had difficulty in swallowing and breathing, but clinically stable. The result is not significant at $p<0.05$.

In the present study, tracheal intubating conditions after 30 seconds of induction were assessed and graded clinically using the criteria as described by Fahey *et al.* Patient who received 0.02mg/kg vecuronium as priming dose produced excellent intubating conditions significantly faster as compared to 0.01mg/kg vecuronium priming dose group. Intubating conditions were score 0 in 64% and score 1 in 36% in group B. In

group A 8% comes under score 1, 88% in score 2 and 4% in score 3. Thus the present study resulting in, the priming dose of 0.02mg/kg vecuronium with 3 minutes prime interval and induced with thiopentone 5mg/kg and 0.1mg/kg of vecuronium resulting in intubation conditions score 0 in 16 patients and score 1 in 9 patients. The P <0.001 was highly significant, thus it was observed that group B showed a significant rapid intubating conditions than group A. In the present study with Group A the mean resting pulse rate was 83.3(5.9) beats/min. It increase to 95.4(6.5) beats/min at 3 minutes after priming dose and at induction. Further rise was seen during laryngoscope and intubation to 98.9(6.9) beats/min. The rise was maximum at 1 minute after intubation and thereafter steadily to reach baseline values at 20 minutes. In the Group B the mean resting pulse rate was 81.7(5.9) beats/min. It increase to 96.6(7.0) beats/min at 3 minutes after priming dose and at induction. Further rise was seen during laryngoscope and intubation to 105.2(7.4) beats/min. The rise was maximum at 1 minute after intubation and thereafter steadily to reach baseline values at 20 minutes. Thus there was a slightly greater increase in the pulse rate in the group B when compared to group A at different time intervals. This was not found to be clinically significant (P>0.05).In the Group A the mean resting systolic blood pressure was 121.8(5.7) mmHg. It increase to 126.0(5.8) mmHg at 3 minutes after priming dose and at induction. Further rise was seen during laryngoscope and intubation to 130.6 (6.1) mmHg. The rise was maximum at 1 minute after intubation 135.9 mmHg.There was a difference of 14.1mmHg from the resting blood pressure and thereafter steadily to reach baseline values at 20 minutes. In the Group B the mean resting systolic blood pressure was 122.6(6.9) mmHg. It increase to 127.2(6.6) mmHg at 3 minutes after priming dose and at induction. Further rise was seen during laryngoscope and intubation to 132.7 (7.6) mmHg. The rise was maximum at 1 minute after intubation 138.0 mmHg.There was a difference of 15.4mmHg from the resting blood pressure and thereafter steadily to reach baseline values at 20 minutes. In our present study the rise in mean systolic blood pressure was slightly greater in the Group B than Group A.The p value was not significant at any time interval (p>0.05). In the Group A the mean resting diastolic blood pressure was 76.7 mmHg. It increases to 80.1mmHg at 3 minutes after priming dose and at induction. Further rise was seen during laryngoscope and intubation to 83.4mmHg.The rise was maximum at 1 minute after intubation 90.2mmHg.Thereafter declined steadily and reached to baseline values at 20 minutes. In the Group B the mean resting diastolic blood pressure was 77.5mmHg.It increase to 82.0mmHg at 3 min after priming dose and at induction .Further rise was seen during laryngoscope and intubation to 85.2mmHg.The rise was maximum at 1 minute after intubation 91.4mmHg. Thereafter declined steadily and reached to baseline values at 20 minutes. In our present study the difference in the mean diastolic blood pressure recordings between two groups was not clinically significant at any time interval (p>0.05) The pulse rate and blood pressure are increased in group B which is not clinically significant at any time interval when compared to group A.

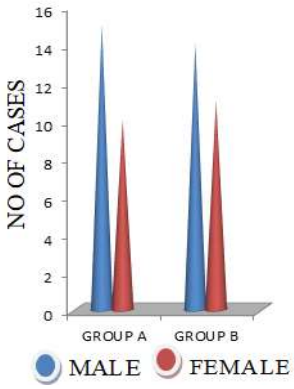


Figure 1: SEX INCIDENCE;

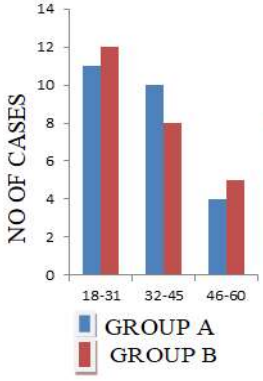


Figure 2: AGE INCIDENCE;

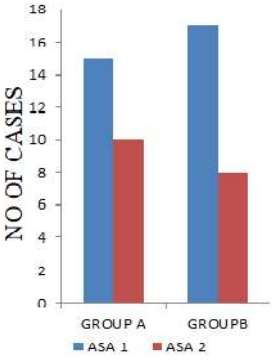


Figure 3: ASA STSTUS

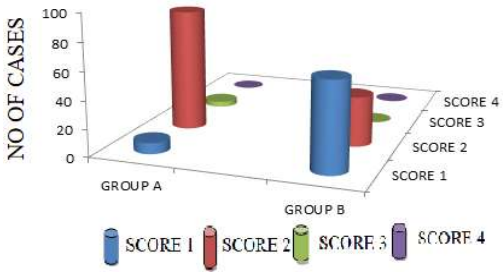


Figure 4: Intubating conditions

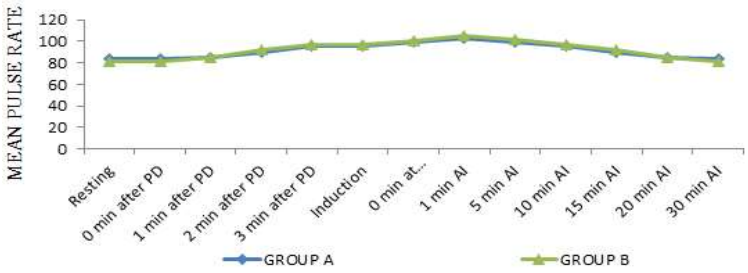
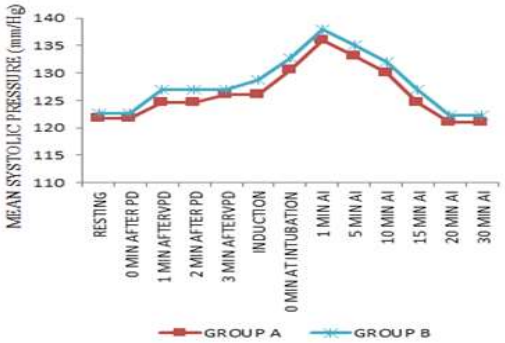


Figure 5: VARIATIONS OF MEAN PULSE RATE



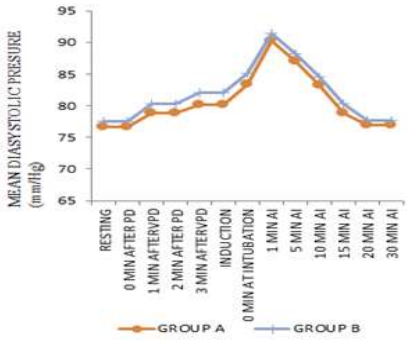


Figure 6: Variations in mean systolic blood pressure; **Figure7:** Variations in mean diasystolic blood pressure

CONCLUSION

In conclusion, we recommend, a priming dose of 0.02mg/kg of vecuronium and inj. fentanyl 1 micrograms/kg intravenous, with 3 minutes of priming interval and induced withinj. Thiopentone sodium intravenous of 5mg/kg and remaining dose of 0.1mg/kg of vecuronium, after 30 seconds patients can be safely intubate as an alternative technique for rapid sequence induction of anaesthesia.

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