Original Research Article

Comparative evaluation of the effects of succinylcholine and rocuronium bromide in intraocular pressure

Anupama Priyadarshini N*

Assistant Professor, Department of Anesthesiology, Modern Government Maternity Hospital, Petlaburz, Hyderabad, India
*Corresponding author email: **drnandaanu@gmail.com**

International Archives of Integrated Medicine, Vol. 4, Issue 6, June, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 16-05-2017 **Accepted on:** 19-05-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Anupama Priyadarshini N. Comparative evaluation of the effects of succinylcholine and rocuronium bromide in intraocular pressure. IAIM, 2017; 4(6): 13-19.

Abstract

Background: Succinylcholine remain unsurpassed in providing ideal intubating conditions in the shortest time among all available neuromuscular blocking agents hence is advocated as the drug of choice for rapid sequence endotracheal intubation.
Aim: Study compared the effects of succinylcholine and rocuronium bromide on intraocular pressure.
Materials and methods: Study was done in 30 samples of ASA physical status 1 and 2 were selected through simple random sampling technique. All patients were scheduled for elective non-opthalmologic surgery for which general endotracheal anesthesia at various intervals at various intervals intraocular pressure changes, pulse rate, systolic and diastolic blood pressure were recorded at each of the above periods.
Results: Intraocular pressure was elevated after giving succinylcholine high above the baseline values while in rocuronium group the intraocular pressure reduced below the baseline values. Though in both the groups IOP rose after intubation and decreased after three and five minutes after intubation, in group S it remained above the baseline after five minutes where as in group R it remained below the baseline value. Increasing after intubation nearing baseline value after five minutes after intubation.
Conclusion: To conclude rocuronium in a dose of 0.9 mg/kg provides good to excellent intubating conditions comparable to that succinylcholine. It is a suitable agent for tracheal intubation in patients undergoing elective and emergency ophthalmic surgery where raise in intraocular pressure is undesirable.

Key words

Rocuronium Bromide, Succinylcholine, Intraocular pressure.

Introduction

Ocular trauma once described as the neglected disorder has recently been highlighted as a major cause of visual morbidity. Worldwide there are approximately 1.6 million people blind from eye injuries, 2.3 million bilaterally visually impaired and 19 million with unilateral visual loss. The spectrum of injuries ranges from very mild, non-sight threatening to extremely serious with potentially blinding consequences. The majority of injuries are minor, affecting the periorbital structure or the ocular surface, such as corneal abrasions or superficial corneal foreign bodies. Only 2-3% of all eye injuries require hospital admission and it is these small minorities of cases that are of interest with regard to management and outcome and therefore have attracted most attention. Over 10% of these people loose useful vision in the injured eye. Serious eye injuries involving the orbit or intraocular structures are usually classified into those caused by blunt objects, small flying particles and burns. The type and extent of damage sustained eye depends on both the mechanism and force of the injury. Penetrating injuries, whether due to large or small objects, are known to carry a poorer prognosis than contusional injuries. However, considerable disruption of the globe may occur with severe blunt trauma which causes tearing of intraocular structures and diffuse changes secondary to energy absorption by the tissues.

The prognosis of severely injured eyes with the development of advanced microsurgical techniques has improved. In the immediate period after the injury, the rapidity with which treatment is instituted may have as important effect on the final outcome. Control of raised intra ocular pressure after blunt trauma reduces the patient pain and prevents secondary corneal and optic nerve damage. An open eye should be repaired as soon as feasible, and closure of a rupture or penetrating injury should always be attempted even for apparently disrupted eye. Even in irreversibly damaged eyes it is psychologically easier for the patient to accept the loss of an eye some days after the initial injury and primary closure should always be attempted. The development of sympathetic opthalmitis in the other eye has always been a concern with the penetrating injuries. It extremely rare and is now considered to be a treatable condition using steroids and cytotoxic agents. The repair of penetrating eye injuries is an emergency and requires general anesthesia. The management of emergency anesthesia requires balancing the need to prevent aspiration of gastric content against prevention of sudden significant raise of intraocular pressure that may further damage eye and loss of vision. In addition, patients may also present with a potential difficult airway posing a further challenge to the anesthesiologist.

Precautions are necessary during the induction of general anesthesia to prevent sneezing and coughing. Local anesthesia is not recommended for repair of ruptured or lacerated globes for the following reasons. Sneezing associated with peribulbar anesthesia would result in the expulsion of intraocular contents, corneoscleral contour is often irregular preoperatively, making sclera perforation with the needle used for anesthesia more likely, Repair of complicated sclera laceration may require manipulation of extraocular muscles, which may cause significant discomfort in the locally anaesthetized eye. Local anesthesia may result in an increased orbital volume because of the volume of anesthesia, which may cause deleterious pressure on the globe. Retrobulbar hemorrhage is an unpredictable complication of retro bulbar anesthesia and can be massive which can occur rapidly. This may quickly result in the expulsion of intraocular contents if the eye is open at the time of hemorrhage.

Succinylcholine remain unsurpassed in providing ideal intubating conditions in the shortest time among all available neuromuscular blocking agents hence is advocated as the drug of choice for rapid sequence endotracheal intubation [1]. However, an increase in intraocular pressure after succinycholine is one of its undesirable effects, especially in patients with open globe eye injury [2, 3]. Rocuronium Bromide is a non-depolarising neuromuscular blocking drug, which provides rapid onset of action when used in a dose of 0.9 to 1.2 kg. The onset time of rocuronium has been shown to be similar to that of succinycholine in these doses. However, rocuronium has an intermediate duration of action and may not be the best during when faced with difficult airway situations. Aim of study was to compare the effects of succinylcholine and rocuronium bromide on intraocular pressure.

Materials and methods

Study was done in 30 samples of ASA physical status 1 and 2 were selected through simple random sampling technique. All patients were scheduled for elective non-opthalmologic surgery for which general endotracheal anesthesia was planned. All patients were informed about the intraocular pressure study and their informed consent was obtained.

Exclusion criteria included age less than 20 years, more than 60 years, patients with difficult airway, glaucoma and high myopia and in patients in whom succinylcholine was contra indicated all the patients were kept nil per oral for 6-8 hours. On arrival of the patient in the operative room, intravenous access was obtained with 18 G cannula.

The sample allocated to two groups of 15 patients each, Group S (N=15) received succinylcholine 1.5 mg/kg i. v and Group R received inj. rocuronium 0.9 mg/kg i.v. All the patients were administrated injection gycopyrrotate 0.2 mg and preoxygenated with 100% oxygen for three minutes by mask with magills circuit. Induction of anaesthesia was done with inj thiopentone 5 mg/kg.

Tracheal intubation was performed after 60 seconds of administration of succinylcholine and rocuronium in Group S and Group R respectively. Maintenance of anesthesia was achieved with 33% oxygen in nitrous oxide, muscular relaxation was achieved with inj. vecuronium 0.08 mg/kg in Group S and inj. rocuronium 0.15mg/kg in-group R whenever required. At the end of the surgery residual neuromuscular blockade was reversed with inj. neostigmine 0.05 mg/kg and inj. atropine 0.002 mg/kg and after confirmation of airway security, trachea was extubated. Intraocular pressure changes was recorded with schiotz tonometer at following time periods; Baseline T0,60 seconds after giving relaxant T1, one minute after intubation T2 three minutes after intubation T3 and 5 minutes after intubation T4.

The pulse rate, systolic and diastolic blood pressure were recorded at each of the above periods.

Intubating condition was also graded as:
Excellent: a fully relaxed jaw with fully abducted vocal cords without any cough reflex.
Adequate: either a partially relaxed jaw or partially abducted vocal cords without any cough reflex.
Poor: either a partially relaxed jaw or partially abducted vocal cords with the cough reflex.

The results obtained were statistically analyzed using student T test and significance ascertained with P values. Paired T test was used for within the group comparison and unpaired T test for between the groups comparison.

Results

The demographic data were comparable between two groups. The mean age of the patients in – groups was 40.2±9.36 where that of the groups R was 40±14.11 the difference between them was not significant.

The mean weight of the patient in group S was 57.8±7.16 kg where as that of group R was 53.6±10.96kg. The difference between the two was not significant. The sex distribution was not different between the groups, 8 male and 7 female patients were enrolled in group S and 7 male and 8 female patients in –group R. The intubuting conditions were also graded to be similar in both groups 15 were graded as excellent in the group S and 14 were graded as excellent in group R. only one as adequate (**Table – 1**).

The baseline intraocular pressure was similar between the groups. Patients in group S had as mean IOP of 14.24±0.87 whereas group R patients had a mean IOP of 14.18±1.06. The P value is 0.867 which is not significant (Table – 2). In Groups S the IOP increased significantly after administration of succnylcholine to 16.41±0.95 it increased further after one minute after intubation to 18.59±1.32 that decreased to 16.47±1.28 after three minutes of intubation and reached to 14.68±0.88 after five minutes after intubation and not reached baseline. In Group R the IOP decreased significantly to the mean 10.31=1.03 after administration. Though it rose to 13.27±1.08 after 1 minute after intubation it decreased to 12.05±0.94 after three minutes after intubution reached 12.40±0.99after 5 minutes after intubation but never reaching baseline (**Table – 2**).

Table - 1: Comparison of Demographic Data.

Group	Age (years)	Weight (kg)	Sex (M:F)
Group S	40.2±9.36	57.8±7.16	8:7
Group R	40±14.11	53.6±10.97	7:8
P value	0.96(N.S)	0.225(N.S)	

Table - 2: Comparison of Intraocular Pressure between Groups at various periods.

Group	Baseline TO	60 sec after relaxant T1	Minutes after Intubation		
			One T2	Three T3	Five T4
S	14.24±0.89	16.41±0.95	18.59±1.32	16.47±1.28	14.68±0.88
R	14.18±1.06	10.31±1.03	13.27±1.08	12.04±0.94	12.40±0.97
P value	0.867(NS)	0.00012(S)	0.00019(S)	0.OOO26(S)	0.00030(S)

Change in IOP with respect TO in group S and Group R at T1,T2,T3 andT4 is significant (P<0.001). The change in IOP is positive in Group S with a mean value of 2.17±0.43 at T1 and 4.35±0.71 at T2 and decreasing to 0.44±0.18 at T4. The change in IOP is negative in group R with a mean value of -3.86±0.49 at T1 and -0.90±0.53 at T2decreasing to -1.78±0.35 at T4 (**Table – 3**).

The baseline value of pulse rate between the both the groups were similar with a mean of 82.27±5.76 for group S mean of 81.13±8.09 for Group R. Both the group showed a peak increase in pulse rate after intubation with a mean of 101.9±5.39 for group S and a mean of 101.73±8.99 for Group R. Further it decreased after three minutes after intubation reaching a mean of 89.33±4.83 in group S and mean of 87.53±6.32 in group R after five minutes of intubation. Both the groups showed similar trends (**Table – 4**).

The baseline values of systolic blood pressure were similar between the groups. The patients in Group S have a mean systolic blood pressure of 122.07±8.9 and that of Group R 124.3 ±14.07. Both the groups showed slight decrease in systolic blood pressure after 60 seconds of giving relaxants. It rose after intubation and started

decreasing after three minutes of intubation and five minutes after intubation. Both the group showed similar trends (**Table – 5**).

The base line values of diastolic blood pressure were similar between the groups. The patients in group S have a mean diastolic blood pressure of 80.53±8.34 and that of Group R 77.47±11.63. Both the groups showed slight decrease in diastolic blood pressure after 60 seconds of giving relaxants. It rose after intubation and started decreasing after three minutes of intubation and five minutes after intubation. Both the group showed similar trends (**Table – 6**).

Table - 3: Comparison of change in Intraocular pressure from baseline in Groups at various periods.

Group	**60sec after relaxant T1**	**Minutes for Intubation**		
		OneT2	**ThreeT3**	**FiveT4**
Group S	2.17±0.43	4.35±0.71	2.23±0.74	0.44±0.18
Group R	-3.8±O.49	-0.9±0.53	2.12±0.38	-1.7±0.35
P value	0.00011(S)	0.00020(S)	0.00023(S)	0.00029(S)

Table - 4: Comparison of pulse rate between Group S and Group R at various periods.

Group	**Baseline TO**	**60 sec after relaxant T1**	**Minutes after Intubation**		
			OneT2	**ThreeT3**	**Five T4**
Group S	82.27±5.76	89±4.92	101.93±5.3	95.93±5.33	89.33±4.83
Group R	81.13±8.09	87.67±7.27	101.73±8.9	95.93±86	87.53±6.32
P value	0.662(NS)	0.562(NS)	0.942(NS)	1(NS)	0.389(NS)

Table - 5: Comparison of Change in systolic Blood pressure between groups at various periods.

Group	**Baseline T0**	**60 sec after relaxant T1**	**Minutes after Intubation**		
			OneT2	**Three T3**	**Five T4**
Group S	122.07±8.99	188.80±9.16	136.53±7.84	131±8.17	124.47±8.5
Group R	124.53±14.07	120.53±12.98	139.60±13.64	133.13±13.27	127.13±14.47
P value	0.572(NS)	0.676(NS)	0.457(NS)	0.6(NS)	0.703(NS)

Table - 6: Comparison of Change in Diastolic Blood Pressure between at various periods.

Group	**Baseline T0**	**60 sec after relaxant T1**	**Minutes after Intubation**		
			One T2	**Three T3**	**Five T4**
Group S	80.53±8.34	77.93±7.98	91.45±6.72	87±6.19	83.80±706
Group R	77.47±11.63	74.53±11.47	89.07±9.85	84.87±10.73	79.73±10.87
P value	0.414(NS)	0.354(NS)	0.443(NS)	0.511(NS)	0.235(NS)

Discussion

Intraocular pressure was measured using schiotz indentation tonometry, which is a simple and most suitable method for use in patients under anesthesia. Factors such as central venous pressure (CVP), arterial carbon dioxide and oxygen tension have got significant effect on IOP. We did not measure CVP as it was considered unnecessary on ethical grounds to insert a CVP line: however all the patients were kept horizontal throughout the period of study and great care was taken to prevent any external

compression of neck veins. Oxygen saturation was continuously measured and the patients were never hypoxic. So, the influence of hypoxia on IOP was also eliminated. Though arterial or end tidal carbon dioxide tension was not monitored, this factor would not have affected the IOP as patients were adequately ventilated. Other factors that influence IOP are premedication, anticholinergic agents and inhalational agents. In our study, no premedication was given, glycopyrrolate was given to both the groups. So, whatever little effect these factors had on IOP would have affected the results in a similar fashion in both the groups.

Thiopentone is known to cause profound decrease in IOP due to various factors, such as its effect on diencephalic centers in midbrain, facilitation of aqueous out flow, relaxation of extraocular muscles and peripheral vasodilatation causing reduction in venous pressure. As mentioned earlier, succinylcholine caused an increase in IOP of about 7-12 mmhg when given in isolation. The lower mean raise in IOP observed in our study was due to attenuation of intraocular hypertensive response of succinylcholine by thiopentone. With thiopentone-rocuronium (groupR), mean fall of IOP was observed which was probably due to IOP lowering effect of rocuronium in addition to that of thiopentone. Similar results were reported by Chiu, et al. [4] and Mitra, et al. [5].

Larygoscopy and tracheal intubation can cause a raise in intraocular pressure even in anaesthetized patients. This is probably due to a raise in arterial pressure as result of sympathetic stimulation. This increase disappears in a few minutes and may not be of any great significance in the majority of the patients who undergo elective ophthalmic surgery, but may be harmful to many patients with penetrating eye injuries or patients already having elevated IOP like in glaucoma. In our study, pressure response to intubation was statistically comparable in between the two groups ($p<0.05$), similar to as observed Chiu, et al. [4] and remained higher than the baseline values even after five minutes of intubation. Similar changes in IOP after intubation were reported by Gulati M, et al. [6] and Vinik HR, et al. [7]. However Rich AL, et al. [8] demonstrated the apparent safety of suxamethonium in patients who underwent surgery for penetrating eye injuries whether this retrospective view of patients presenting for such surgery in 1982 at one faculty representative of results to be expected elsewhere must remain an open question.

In thiopentone rocuronium group IOP was similar to baseline value after tracheal intubation. In the post intubation period, IOP rapidly `decreased as the effect of stimulus worn off. All the observation in the post intubation period upto after five minutes of intubation was lower than the baseline. Similar findings were observed Chiu, et al. [4] and Mitra, et al. [5] expect that IOP after intubation was lower than the baseline in contrast to our study.

All the 15 patients in group S who received succinylcholine 1.5 mg/kg had excellent intubating conditions after 60 seconds of induction. Our findings are in agreement with those of Hunter, et al. [9] and Miller [10] and Malik P [11] who also reported that excellent incubating conditions with succinylcholine could be achieved within 60-70 seconds of its administration. With rocuronium excellent incubating conditions were achieved in 14 patients and adequate intubating conditions in one patient. No patient coughed of bucked during tracheal intubation. Both the groups were statistically comparable regarding intubating conditions, like that reported by Sparr, et al. [12].

Conclusion

A study of changes in intraocular pressure during intubation was studied in 30 patients of ASA physical status I and II undergoing elective surgical procedures. Intraocular pressure was elevated after giving succinylcholine high above the baseline values while in rocuronium group the intraocular pressure reduced below the baseline values. Though in both the groups IOP

rose after intubation and decreased after three and five minutes after intubation, in group S it remained above the baseline after five minutes where as in group R it remained below the baseline value. However, the hemodynamic changes showed similar trends in both the groups, increasing after intubation nearing baseline value after five minutes after intubation.

To conclude rocuronium bromide in a dose of 0.9 mg/kg provides good to excellent intubating conditions comparable to that succinylcholine. It is a suitable agent for tracheal intubation in patients undergoing elective and emergency ophthalmic surgery where raise in intraocular pressure is undesirable.

References

1. Cook JH. The effect of suxamethonium on intraocular pressure. Anaesthesia, 1981; 36: 359-65.
2. Maharaj RJ, Humphrey D, Kaplan N, et al. Effects of atracurium on intraocular pressure. Br J Anaesth., 1984; 56: 119-24. 3.
3. Boy LH, Knape HT. The neuromuscular blocking effects of ORG - 9426. A new intermediate acting non depolarizing muscle relaxant in man. Anaesthesia, 1991; 46: 391-3.
4. Chiu CL, Jaais F, Wang CY. Effect of rocuronium compared with succinylcholine on intraocular pressure during rapid sequence induction of anaesthesia. Br J Anaesth, 1999; 82: 757-60.
5. Mitra S, Gombar KK, Gombar S. The effect of rocuronium on intraocular pressure: a comparison with succinylcholine. Indian J. Anaesth., 2002; 46(2): 138–141.
6. Gulati M, Mohta M, Ahuja S, Gupta VP. Comparison of laryngeal mask airway with tracheal tube for ophthalmic surgery in paediatric patients. Anaesth Intensive Care, 2004; 32: 383–9.
7. Vinik HR. Intraocular pressure changes during rapid sequence induction and intubation: a comparison of rocuronium, atracurium and succinylcholine. J Clin Anesth., 1999; 11: 95-100.
8. Rich AL, Witherspoon ED, Morris RE, Feist RM. Use of nondepolarizing anaesthetic agents in penetrating ocular injuries. Anesthesiology, 1986; 65: 108–109.
9. Hunter JM. Rocuronium: the newest aminosteroid neuromuscular blocking drug. Br J Anaesth., 1996; 76: 481–486.
10. Magorian T, Flannery KB, Miller RD. Comparison of rocuronium, succinylcholine and vecuronium for rapid sequence induction of anaesthesia in adult patients. Anesthesiology, 1993; 79: 913–918.
11. Malik P, Rao S, Malhotra N, Chugh JP, Hooda S. Comparative evaluation of effect of rocuronium and succinylcholine on intraocular pressure. J Anaesth Clin Pharmacol., 2004; 20(3): 255–261.
12. Sparr HJ, Giesinger S, Ulmer H, et al. Influence of induction technique on intubating conditions after rocuronium in adults: comparison with rapid sequence induction using thiopentone and suxamethonium. Br J Anaesth., 1996; 77: 339-342.