Original Research Article

Effect of Rocuronium and Succinylcholine on intraocular pressure during intubation: An institution based comparative study

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Abstract

Background: Anaesthetic management plays a very vital role in the successful outcome of surgeries anywhere, and the eye is no exception. Because of the comparatively small area of surgical field, and the anatomical isolation of the eye and its appendages, it is possible to carry out most surgeries in the eye under local anaesthesia. **Aim:** To compare the effects of Rocuronium and Succinylcholine on intraocular pressure during induction of anaesthesia and intubation in patients undergoing non-ophthalmic surgeries. **Materials and Methods:** 40 adult patients were included in this single blind, randomized, controlled study with the Rocuronium group (study group) who received Rocuronium at a dose of 0.6mg/kg and the Succinylcholine group (control group) who received Succinylcholine at dose of 2mg/kg. **Statistical Analysis:** The observations made were tabulated and analyzed using SPSS software version 16. Unpaired 't' test was used to analyze the baseline clinical variables and patient characteristics. 'Z' test was applied to calculate the ratios regarding ASA grading and male and female number of cases. Paired `t' test was used to analyze the intraocular pressure changes at different times. **Conclusions:** Succinylcholine can be replaced by Rocuronium in eye injuries or in conditions where a rise in intraocular pressure can be deleterious to the patient.

Key Words: Succinylcholine, Rocuronium, intraocular pressure, randomized, relaxant.

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INTRODUCTION

Anaesthetic management plays a very vital role in the successful outcome of surgeries anywhere, and the eye is no exception. Because of the comparatively small area of surgical field, and the anatomical isolation of the eye and its appendages, it is possible to carry out most surgeries in the eye under local anaesthesia. It was in fact the poor quality of general anaesthesia that prompted Carl Koller1 (1857-1944) in Vienna in 1884, to seek practical means of producing local analgesia of the eye and to employ cocaine for this purpose – thereby initiating the whole concept of local analgesia in surgery. Local anaesthesia is most unsuitable in small children and other non co-operative patients, for major operative procedures, those sensitive to local anaesthetics and those with inflammatory diseases of the eye that may be worsened by local anaesthesia. These days a lot of cases of eye injuries need surgical exploration under general anaesthesia. The maintenance of normal or lowered intraocular pressure (IOP) is important during ocular surgery. Several techniques have been employed to try to prevent increase in intraocular pressure during surgery. The most common drug used in anaesthetic practice, which raises intraocular pressure, is succinylcholine[2]. Succinylcholine produces an undesirable rise in intraocular pressure[3], which may prove disastrous in patients with eye injuries. The use of defasciculating dose of non-depolarizing muscle relaxants before succinylcholine, self- taming, lignocaine, diazepam and

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other drugs, and the substitution of non-depolarizing relaxants of intermediate duration like atracurium[4] or vecuronium[5] for succinylcholine have all been ineffective with inconsistent results. These inconsistent results have been mainly due to increased delay in obtaining full relaxation and sub optimal intubating conditions. Rocuronium (ORG –9426), a non- depolarizing muscle relaxant, has been shown to provide adequate intubating conditions with rapid onset, an intermediate duration and no obvious side effects[6].

MATERIALS AND METHODS

Study Design: This study was conducted at Kannur Medical College Hospital, Anjarkandy,Kannur between February 2011 and February 2012. It was a single blind, randomized, controlled study. The Rocuronium group (study group) who received Rocuronium at a dose of 0.6mg/kg and the Succinylcholine group (control group) who received Succinylcholine at dose of 2mg/kg. 40 adult patients of ASA I & II class, satisfying the selection criteria, undergoing elective non-ophthalmic surgery was studied. Patients were randomly allocated to one of the two groups (n = 20 each) to receive succinylcholine (S group) or rocuronium (R group).

Inclusion Criteria

- Adult male or female patients of the range of 18-45 years.
- Subjected to general anaesthesia for non-ophthalmic surgery.
- Belonging to ASA I or II class.

Exclusion Criteria

- Patients with ocular disease with or without raised intraocular pressure
- History of drug allergy.
- Patients with anticipated difficult intubation belonging to MPC III/IV
- Patients having significant metabolic disease or impaired renal/ hepatic function.
- Patients with neuromuscular disorders.
- Patients currently taking medications known to affect neuromuscular transmission.
- Pregnant women.

The patients who were selected and posted for non-ophthalmic surgeries were scrutinized and the first 40 patients were selected for our study as per criteria mentioned above. They were randomly divided into the succinylcholine group and rocuronium group using the random number chart.

Materials

- Schiotz tonometer
- Injection Rocuronium bromide 50mg/ml. (Esmeron) (Organon Teknika)
- Injection Succinylcholine 50mg/ml.
- 4% lignocaine HCl to anaesthetize cornea.

Monitors

- Non-invasive blood pressure monitoring
- Pulse oximeter
- ECG
- $ETCO_2$ (End Tidal Carbon Dioxide)
- Finger on the pulse

Interventions

Preparation:

During pre-anaesthetic check up, psychological preparation was done and the patients were explained the process of general anaesthesia in advance. All patients received oral diazepam (0.2mg/kg) the night before and morning of surgery.

Premedication Room: All patients received premedication 45 minutes prior to induction, in the pre medication room. Injection pethidine and injection promethazine were given intramuscularly in a dose of 1mg/kg and 0.5mg/kg respectively.

On the table: The baseline intraocular pressure was measured just prior to induction of anaesthesia, after installation of topical Lignocaine HCl 4%. The baseline blood pressure was also recorded at the same time. After pre oxygenation of 3minutes duration, general anaesthesia was induced intravenously with injection, Thiopentone sodium (2.5% soln.), in a dose of 5-7 mg/kg. To minimize the risks of coughing, straining etc after intubation additional doses of Thiopentone sodium was given. Inj. Preservative free Lignocaine (2%), 1.5mg/kg was given 90 seconds before intubation to attenuate the stress response. This was followed by either succinyl choline (2mg/kg) or rocuronium (0.6mg/kg) i.v. The relaxant drug was administered into a rapidly running intravenous line by a competent anaesthesiologist, which may be either rocuronium or succinylcholine. Laryngoscopy and tracheal intubation was performed by another competent anaesthesiologist 60 seconds after administration of muscle relaxant and was completed within 30 seconds in all patients. After intubation, the patient's lungs were ventilated with 66% N_2O in oxygen using Bains circuit, with a flow rate of 70ml/kg to maintain $ETCO_2$ of 25-35mm of Hg.

Intraocular pressure Measurements

Base line intraocular pressure, after pre medication, just prior to induction. After induction with Thiopentone sodium and loss of eyelash reflex. Immediately after intubation. 3mins after administration of relaxant. 5mins after administration of relaxant.

All patients were in horizontal supine position while intraocular pressure was measured and care was taken to avoid any external compression of neck veins.

Data Collection: The readings of intraocular pressure were taken with a Schiotz tonometer by the principal investigator himself.

Statistical Analysis: The observations made were tabulated and analyzed using SPSS software version 16. Unpaired 't' test was used to analyze the baseline clinical variables and patient characteristics. 'Z' test was applied to calculate the ratios regarding ASA grading and male and female number of cases. Paired `t' test was used to analyze the intraocular pressure changes at different times.

OBSERVATIONS AND RESULTS

The patients in both groups, succinylcholine (S group) and the Rocuronium (R group) did not differ significantly on any baseline variables or patient characteristics.

Table 1: Patient characteristics and baseline clinical variables

	S group n=20)	R groupn=20)	t Value	P Value	Comments
Age (years)	30.75±5.09	29.6±4.511	0.73623	P<.05	Not significant
Sex M:F	3:17	5:15	0.1265	P<.05	Not significant
Weight (Kg)	53.05±3.52	52.8±3.04	0.3268	P<.05	Not significant
ASA I:II	16:04	15:05	0.3785	P<.05	Not significant
Base Line Systolic BP	131.3±6.85	131.5±6.42	0.0996	P<.05	Not significant
Base Line Diastolic BP	83.3±4.01	84.3±4.12	0.777	P<.05	Not significant
Baseline Right IOP	16.41±1.82	16.49±1.89	0.1337	P<.05	Not significant
Baseline Left IOP	16.31±2.13	16.22±1.98	0.1285	P<.05	Not significant

Table 2: Comparison of IOP changes after induction with Thiopentone sodium

	Right eye	Left eye
Group S	13.49±2.04	13.39±2.15
Group R	13.57±2.15	13.52±2.31
T value	0.0979	0.1809
P value	P<.05	P<.05
Comments	Not significant	Not significant

In both the groups the intraocular pressure values decreased at induction with thiopentone sodium. The mean difference from the baseline was about 4mm of Hg.

Table 3: Comparison of IOP changes immediately after intubation

	Right eye	Left eye
Group S	18.23±1.54	18.13±1.25
Group R	15.12±1.85	16.09±2.08
t value	5.4688	3.681
P value	P>.05	P>.05
Comments	significant	significant

After laryngoscopy and intubation, the intraocular pressure vales in group S showed a significant rise above the baseline. In contrast, intraocular pressure never exceeded the baseline values in the R group.

Table 4: Comparison of IOP changes 3 minutes after relaxant

	Right eye	Left eye
Group S	20.62±1.13	20.44±.96
Group R	16.44±2.07	16.11±2.20
t value	8.459	10.004
P value	P>.05	P>.05
comments	significant	significant

Three minutes after relaxant the IOP changes in the S group was higher when compared to the previous values, whereas in the R group there was no significant rise in intraocular pressure, when compared to previous recordings.

Table 5: Comparison of IOP changes 5 minutes after relaxant

	Right eye	Left eye
Group S	17.66±2.01	17.65±1.76
Group R	15.26±1.94	15.15±2.05
t value	3.5998	4.381
P value	P>.05	P>.05
comments	significant	Significant

After 5 minutes there was a significant fall in the intraocular pressure values in the S group, but they never reached up to the baseline values. But for the R group intraocular pressure values remained significantly below the baseline.

DISCUSSION

Maintenance of intraocular pressure as near normal as possible, during anaesthesia is one of the primary goals of an anaesthesiologist. In the present study the use of rocuronium during induction did not cause a rise in intraocular pressure when compared with succinylcholine. The studies comparing the effect of rocuronium and succinylcholine on intraocular pressure are scanty. Chiu *et al*[7] compared the effect of rocuronium and succinylcholine on intraocular pressure during rapid sequence induction of anaesthesia using propofol and fentanyl in a randomized, double blind study of 30 patients. Rocuronium 0.9 mg/kg was used. Intraocular pressure in the succinylcholine group was found to be significantly greater than that in the rocuronium group, whereas the intubating conditions were equally good. In another publication from USA, Vinik[8] compared rocuronium, atracurium and succinylcholine with regard to their effect on intraocular pressure during rapid sequence induction of anaesthesia in 45 patients. Using an open label, randomized study design, a fixed combination of midazolam, alfentanil and propofol was given in non premedicated patients. Rocuronium was used in the dose of 0.6 mg/kg. It was observed that the percentage change

in intraocular pressure from the baseline was significantly decreased in the rocuronium group when compared to the succinylcholine group. In a recent publication from our country, Mitra *et.al*[9] compared the effect of rocuronium and succinylcholine on intraocular pressure, in 40 adult patients undergoing non-ophthalmic surgeries. It was a randomized controlled trial following premedication with oral diazepam and induction with propofol. The dose of rocuronium was 0.6 mg/kg. Though these studies differ in certain methodological aspects such as premedication, induction agents, dose of rocuronium, setting and patient characteristics, yet the findings of the present study are consistent with the previous ones. High doses of non-depolarizing agents are known to produce prolonged neuromuscular blockade. The dose of rocuronium used in the present study was 0.6 mg/kg instead of the currently recommended dose of 0.9-1.2 mg/kg. But even with this dose there was no difficulty in intubation and lowering of intraocular pressure were seen. This may be explained by the fact that use of adequate doses of thiopentone sodium and pethidine might have increased the depth of anaesthesia. The major increase in intraocular pressure due to succinylcholine is caused by contraction of extra ocular muscles although dilatation of choroidal vessels is a contributory factor. Rocuronium reduces the tone of extra ocular muscles and produces decrease in arterial and venous pressure due to paralysis. The obvious advantage of rocuronium would be its property of not raising the intraocular pressure and indeed, as found in our study, it may significantly lower intraocular pressure when used with thiopentone and pethidine.

CONCLUSIONS

After analyzing the results, we find that Rocuronium in a dose of 0.6 mg/kg when used with thiopentone sodium and pethidine could prevent the rise in intraocular pressure that was seen with succinylcholine. Succinylcholine can be replaced by rocuronium in eye injuries or in conditions where a rise in intraocular pressure can be deleterious to the patient.

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