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Comparison of Equipotent Doses of Cisatracurium and Rocuronium at Bhuj, Kutch

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Abstract

Background and Aim: For several decades, suxamethonium was the gold standard relaxant for rapid sequence intubation. However, the unintended side-effects such as muscle fasciculation, hyperkalemia, rise in intracranial and intraocular pressures led to the search of newer relaxants. In this study we compared the most recent rocuronium and cisatracurium at a dose as regard the onset of action, intubating conditions, efficacy, and safety during general anesthesia for adult gynecological ambulatory surgery. *Materials & Methods:* Total of 90 patients were randomly selected and included in the present study. The age range for the patient was found to be 25 to 65 years. All the included patients were randomly divided into two groups, 45 patients in each group. In the first group Rocuronium 0.6 mg/kg was administered and in other group 0.1 mg/kg was administered. *Results:* The time to achieve maximum blockade was 160.4 sec and 85.94 sec respectively in Group A and Group B. The clinical duration was found to be 48.9 mins and 32.8 min respectively in group A and B. Total intubation score achieved at 60 secs was 6.36 and 8.12 seconds respectively for group A and group B. *Conclusion:* Rocuronium has a rapid onset of action with good intubating conditions, Cisatracurium has an intermediate duration of action, and both are potent and safe with excellent cardiovascular stability and without apparent histamine release.

Keywords: Cisatracurium; Complications; Equipotent Doses; Rocuronium.

Introduction

Cisatracurium is a bisbenzyl tetrahydroiso quinolinium that has effect as a neuromuscular-blocking drug or skeletal muscle relaxant in the category of non-depolarizing neuromuscular-blocking drugs, used adjunctively in anesthesia to facilitate endotracheal intubation and to provide skeletal muscle relaxation during surgery or mechanical ventilation. It shows intermediate duration of action. Cisatracurium is one of the ten isomers of the parent molecule, atracurium. Moreover, cisatracurium represents approximately 15% of the atracurium mixture [1].

Cisatracurium is indicated for use during surgical and other procedures and in intensive care in adults and children aged 1 month and over. It can be used as an adjunct to general anaesthesia, or sedation in the Intensive Care Unit (ICU) to relax skeletal muscles, and to facilitate tracheal intubation and mechanical ventilation. Cisatracurium should only be administered by or under the supervision of anaesthetists or other clinicians who are familiar with the use and action of neuromuscular blocking agents [2]. Facilities for tracheal intubation and maintenance of pulmonary ventilation and adequate arterial oxygenation have to be available [3].

Cisatracurium should not be mixed in the same syringe or administered simultaneously through the

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same needle as propofol injectable emulsion or with alkaline solutions such as sodium thiopentone. This medicinal product contains no antimicrobial preservative and is intended for single patient use [4].

Rocuronium bromide is an aminosteroid non-depolarizing neuromuscular blocker or muscle relaxant used in modern anaesthesia to facilitate endotracheal intubation by providing skeletal muscle relaxation, most commonly required for surgery or mechanical ventilation [5]. It is used for both standard endotracheal intubation and rapid sequence induction (RSI), although Suxamethonium chloride is usually selected for RSI given its fast onset of action compared with rocuronium [6,7].

It was designed to be a weaker antagonist at the neuromuscular junction than pancuronium; hence its monoquaternary structure and its having an allyl group and a pyrrolidine group attached to the D ring quaternary nitrogen atom. Rocuronium has a rapid onset and intermediate duration of action.

There is considered to be a risk of allergic reaction to the drug in some patients, but a similar incidence of allergic reactions has been observed by using other members of the same drug class [8]. An ideal neuromuscular blocking agent for intubation should have a rapid onset, brief duration of action, provide excellent intubation conditions and should be free from side-effects. For several decades, suxamethonium was the gold standard relaxant for rapid sequence intubation. However, the unintended side-effects such as muscle fasciculation, hyperkalemia, rise in intracranial and intraocular pressures led to the search of newer relaxants [9]. Though vecuronium (V) and atracurium were found to have shorter onset times than the older nondepolarizing muscle relaxants, they did not serve the purpose of rapid sequence intubation. In this study we compared the most recent rocuronium and cisatracurium at a dose as regard the onset of action, intubating conditions, efficacy, and safety during general anesthesia for adult gynecological ambulatory surgery.

Materials & Methods

The study was conducted at Department of Anesthesia Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat. Total of 90 patients were randomly selected and included in the present study. The age range for the patient was found to be 25 to 65 years. All the patients were scheduled for various surgical procedures under general anaesthesia were enrolled for the study.

Exclusion criteria: Patient with anticipation of mask ventilation and difficulty in intubation, liver disorder, neuromuscular disorder, allergy to drugs and pregnancy, having weight less than 40 kg.

All the patients were explained about the procedures and ere asked to sign the informed consent prior inclusion in the study. All the included patients were preoperatively assessed for history recoding, ECG, Hemoglobin, full clinical examination, presence of inclusion and exclusion criteria. All the included patients were randomly divided into two groups, 45 patients in each group. In the first group Rocuronium 0.6 mg/kg was administered and in other group 0.1 mg/kg was administered.

All the included patients were premedicated with diazepam 5 – 10 mg orally, 1 hour prior to the administration of anaesthesia. On arrival in the operating room (OR), the vital parameters were recorded, a venous line was secured and infusion of crystalloid solution was started, the electrocardiogram (ECG), haemoglobin oxygen saturation and non invasive arterial pressure were moniterd. Ulnar nerve stimulation was used to assess the neuromuscular blockade with the help of twitch height. In order to monitor the neuromuscular transmission, volar surface of wrist on ulnar side was used and surface electrode was attached and the corresponding thumb was used to fix the transducer.

Following placement of standard monitors and intravenous access, all the patients were preoxygenated with 100% oxygen for 3 min and received inj. thiopentone sodium 2.5% I.V. till eyelash reflex disappeared. Once the control response was gained, neuromuscular blocking agent for intubation was injected as per the groups. Cisatracurium 0.1 mg/kg IV was given in the group A whereas patients in group B received rocuronium bromide 0.6 $mgkg^{-1}$.

Onset time for the particular relaxant was the time duration from injection of relaxant to the maximum depression of twitch height. After 30 seconds of injection of the relaxant endotracheal intubation was done by the other anaesthetist who was not involved in the anesthesia technique and was consequently blinded to the used relaxant in the study. The conditions at intubation were assessed using the four-point scale of Cooper [Table 1], which was a modification of Krieg's scale. Intubation was graded according to the score attained on Cooper scale as excellent (8-9), good (6-9), fair (3-5) or poor (0-2). TOF stimulus was repeated every 5 min till the recovery of the first twitch.

The cuff of tube was connected to the brain circuit and controlled ventilation was started. The duration

of action of relaxant was noted down. Patients were maintained with oxygen and nitrogen oxide halothane and atraciurium and at the end of surgery; muscle paralysis was reversed with inj. atrophine. At the end of the study, data collected were statistically compared using student t test and chi square test.

Results

Data of Patients in both the groups were compared for the demo graphs, they were found to be statistically significant but however none of the patient had a body weight, more than 20% above the expected weight.

The time to achieve maximum blockade was 160.4 sec and 85.94 sec respectively in Group A and Group B. The clinical duration was found to be 48.9 mins and 32.8 min respectively in group A and B. Total intubation score achieved at 60 secs was 6.36 and 8.12 seconds respectively for group A and group B. However the difference was not found to be statistically significant. in either group, no significant complications were recorded at the time of intubation. There was no intraoperative skin reaction, broncho-spasm, O_2 desaturation, or hypotension in both groups.

Table 1: Cooper scale for criteria and score of conditions of intubation

Jaw Relaxation	Vocal Cords	Response to intubation	Score
Poor	Closed	Severe coughing bucking	0
Minimal	Closing	Mild cough	1
Moderate	Moving	Slight diaghragmatic movement	2
Good	Open	None	3

Table 2: Onset time and duration of action of neuromuscular blocking agent

	Group – A	Group -B
Onset time		
Range	120 – 200 sec	70 – 90 sec
Mean	160.4 sec	85.94 sec
		P < 0.001
Duration of action		
Range	40 – 58 mins	26 – 38 mins
Means	48.9 mins	32.8 mins
		P < 0.001
Total Intubation score		
Range	1 – 10	5 – 10
Mean	7.36	6.12
		P > 0.1

Discussion

Neuromuscular blockers (NMB) are very important adjuvant to general anesthesia. Rocuronium is the most recent available aminosteroidal NMB. Cisatracurium is the most recent iso-quinolone NMB which is 3-4 times more potent than atracurium, has the same advantage of Hofmann degradation and it does not seem to release histamine [10].

Initial studies in animals showed that rocuronium, being a low potency compound, was associated with a rapid onset of effect when compared with other compounds such as pancuronium and vecuronium [11]. This has since been demonstrated in many clinical studies that the onset of action of rocuronium is significantly faster when compared to equipotent doses of atracurium and vecuronium, although slightly slower than that of Cisatracurium That's why rocuronium was selected for the purpose of rapid sequence induction, in the present study. Rocuronium had a significant shorter onset time than cisatracurium and this rapid onset of rocuronium correlate with previous study done by Levy et al [12].

Rocuronium had a significant shorter duration of action than cisatracurium and this finding is consistent with Lepage et al [13] who concluded that cisatracurium is a very potent NMB with an intermediate duration of action characterized by excellent cardiovascular stability, with no apparent histamine release.

Use of higher dose of rocuronium to improve intubating conditions during rapid sequence intubation and to cut short the onset time below 60 secs has been advocated by various workers but doses

larger than 0.6 $mgkg^{-1}$ would be associated with a long duration of action which may be inappropriate in many situations.

The intubating conditions at 60 sec after rocuronium were clinically acceptable in about 80% of patients in our study and this is similar to the results of Chetty et al [14]. In consistent with our results Zhou et al [14] reported 84% clinically accepted intubating conditions after 60 sec. There were no evidences of any significant clinical cardiovascular changes in both groups. The heart rates were significantly elevated in both groups.

No significant side effects were observed during laryngoscopy and intubation in both the groups however non significant complications like arrythmias and laryngospasm did appear in 70% patients of each group and were likely to be due to adrenergic responses during laryngoscopy and intubation, rather than to the effect of drugs. Rocuronium has a rapid onset of action with good intubating conditions, Cisatracurium has an intermediate duration of action, and both are potent and safe with excellent cardiovascular stability and without apparent histamine release.

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