



Original Article

A Study to Compare the Effect of Cisatracurium and Rocuronium Pretreatment on Succinylcholine Induced Fasciculations and Myalgia

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ABSTRACT

Introduction: Fasciculations and myalgia are common side effects of succinylcholine used for tracheal intubation. They are minimised by precurarisation with a small dose of nondepolarising muscle relaxant such as rocuronium and cisatracurium. The purpose of this study is to compare the effectiveness of rocuronium and cisatracurium in prevention and reduction of succinylcholine induced muscle fasciculations and myalgia.

Objectives:

1. To study the efficacy of cisatracurium and rocuronium pretreatment in preventing succinylcholine induced fasciculations in patients undergoing general surgery.
2. To study the efficacy of cisatracurium and rocuronium pretreatment in preventing postoperative myalgia in post-anesthesia care unit(PACU) and myalgia at 24 hours in patients undergoing general surgery.

Materials and methods: The study was prospective, randomized, double blind control study. Total 100 patients under ASA category I and II planned for elective surgery requiring endotracheal intubation were included. The patients selected were randomly assigned by computer into one of the two groups (group 1 - received intravenous (I.v) cisatracurium 0.01 mg/kg and group 2 - received I.v rocuronium 0.06 mg/kg). Fasciculations, postoperative myalgia in PACU and myalgia at 24 hours were documented.

Results: There was 74% reduction in the incidence of muscle fasciculation in the group pretreated with rocuronium compared to cisatracurium (18%). The reduction in incidence of myalgia in PACU was 78% in group pretreated with rocuronium compared to cisatracurium (20%). The reduction in post-operative succinylcholine induced myalgia in PACU at 24 hours was 94% in rocuronium, and 48% in cisatracurium.

Conclusion: From our study we conclude that rocuronium is more efficacious in preventing succinylcholine induced muscle fasciculations and post operative myalgia in comparison with cisatracurium.

Keywords: Fasciculations, myalgia, succinylcholine.

INTRODUCTION

Fasciculations are visible muscle contractions resulting from asynchronous firing of muscle fibers in millions of motor units.¹ During anesthesia fasciculations arise from the prejunctional actions of depolarizing muscle relaxants specifically succinylcholine. Although fasciculations are a relatively benign side effect of succinylcholine, they are associated with post-operative myalgia and hence we try to prevent them.^{1, 2} The use of succinylcholine also produces other undesirable effects such as increased intracranial pressure, intraocular pressure, hyperkalemia, myoglobinuria and increased creatinine kinase level. Because of the risk of rhabdomyolysis, hyperkalemia and cardiac arrest in children with undiagnosed myopathies, succinylcholine is contraindicated in the routine anesthetic care for these children and adolescents.³

Fasciculations are minimised by precurarisation with a small dose of nondepolarising muscle relaxant (NDMR) to suppress fasciculations. Therefore we compare the efficacy of two NDMRs (i.e. cisatracurium and rocuronium) for reducing succinylcholine induced muscle fasciculations. D-tubocurarine is considered the gold standard NDMR used for defasciculation and it is the NDMR of choice with many anaesthesia care providers.² The side effects of d-tubocurarine include histamine release leading to hypotension and bronchospasm.⁴ This prompted research regarding the efficacy of other NDMR that were more efficacious for defasciculation and gave fewer serious side effects. Rocuronium and cisatracurium are newer NDMR tried for the efficacy of defasciculation.^{4, 5} The incidence of myalgia varies from 5% to 85%. Pretreatment with several NDMRs decreased the incidence of myalgia by approximately 30%.⁶

OBJECTIVES

- To study the efficacy of cisatracurium and rocuronium pretreatment in preventing succinylcholine induced fasciculations in patients undergoing general surgery.
- To study the efficacy of cisatracurium and rocuronium pretreatment in preventing postoperative myalgia in post-anaesthesia care unit(PACU) and myalgia at 24 hours in patients undergoing general surgery.
- To compare the efficacy of cisatracurium and rocuronium pretreatment in preventing succinylcholine induced fasciculations, postoperative myalgia in PACU and myalgia at 24 hours in patients undergoing general surgery.

MATERIALS AND METHODS

Source of data:

The present study is conducted on the patients at Basaveshwar teaching and general hospital attached to Mahadevappa Rampure Medical College, Kalaburagi.

Method of collection of data:

Study design: Double blind randomized control study

Place of study: Department of Anesthesiology, Basaveshwar teaching and general hospital, Mahadevappa Rampure Medical College, Kalaburagi

Sample size: 100

- Group 1- 50 cases receive injection cisatracurium 0.01 mg /kg intravenously
- Group 2 -50 cases receive injection rocuronium 0.06 mg/kg intravenously
- Period of study: 01-08-2022 to 31-07-2023 (12 months)

Inclusion criteria

1. Patients undergoing elective surgery under general anesthesia
2. Patients age between 18-60 years
3. Patients who fulfill American Society of Anesthesiology category I and II

Exclusion criteria

1. Cardiovascular, pulmonary or metabolic diseases
2. Morbid obesity
3. Neuromuscular disease
4. Anticipated airway difficulties
5. Intraocular hypertension
6. Malignant hyperthermia
7. Caesarean section

METHODOLOGY

The patients selected were randomly assigned by computer into one of the three groups, group 1 receive intravenous (IV) cisatracurium 0.01 mg /kg and group 2 receive IV rocuronium 0.06 mg.

Patients admitted were connected to basic monitors like pulse oximeter, noninvasive blood pressure, ECG, end tidal CO₂. Patients were given premedication injection glycopyrolate 0.2 mg i.v and preoxygenated with 100% oxygen for 3 minutes. After administration of study drug, patient was oxygenated with bag and mask and monitored for 3 minutes. Then general anaesthesia was induced with injection fentanyl 2µg/Kg IV, injection propofol 2 mg/kg IV followed by injection succinylcholine 1.5 mg/kg IV.

Intensity of fasciculation were assessed by an experienced anesthesiologist using Harvey scale. Laryngoscopy was performed 1 minute after administration of succinylcholine.

Intensity of fasciculations

Graded as 4 point rating scale

Absent	No fasciculations
Mild	Fine fasciculations of the eye, face and neck or fingers without limb movement
Moderate	Fasciculations of greater intensity than mild that occurred at more than two sites or that produced limb movement
Severe	Vigorous, sustained, and widespread fasciculations possibly requiring forceful retention

Table 1: Grading of intensity of fasciculations

Maintenance of Anaesthesia

Anaesthesia was maintained with sevoflurane 1% combination with nitrous oxide 67% and 33% of oxygen. Supplemental doses of fentanyl 25 to 50 µg IV was given. Mechanically ventilated to maintain an end tidal carbon dioxide of 32 to 36 mmHg. Maintenance doses of rocuronium 0.5 mg/kg IV every half hour or cisatracurium 30 microgram/kg i.v every 20 minutes were administered as necessary. Residual neuromuscular blockade was reversed with injection neostigmine 50 µg/kg IV and injection glycopyrolate 10 µg/kg IV.

Occurrence and severity of myalgia was assessed in the Post Anaesthesia Care Unit (PACU) and at 24 hours postoperatively. The intensity of myalgia was assessed using a four point rating scale.

Intensity of myalgia at PACU and at 24 hours postoperatively

Absent	No Muscle Pain
Mild	Muscle stiffness or pain, when specifically asked about in the nape of the neck, or in the shoulders and lower chest on deep breathing
Moderate	Muscle stiffness and pain spontaneously complained of by the patient that requires analgesics
Severe	Incapacitating generalized muscle stiffness or pain.

Table 2: Grading Intensity of myalgia at PACU and at 24 hours postoperatively

RESULT

Table 3: Comparison of fasciculation between cisatracurium and rocuronium

Variables	No. of cases	Nil No. (%)	Mild No. (%)	Moderate No. (%)	Severe No. (%)	Fisher exact test P-Value
Group-1 Cisatracurium	50	9 (18.0%)	12 (24.0%)	28 (56.0%)	1 (2.0%)	P = 0.0001 HS
Group-2 Rocuronium	50	37 (74.0%)	10 (20.0%)	3 (6.0%)	0 (0.0%)	

NS= not significant, S=significant, HS=highly significant

Among the cisatracurium group 12 (24.0%) had mild fasciculation. The proportion of moderate and severe fasciculation in cisatracurium group was 28 (56.0%) and 1 (2.0%) respectively. Among the rocuronium group 10 (20.0%) had mild fasciculation. The proportion of moderate and severe fasciculation in rocuronium group was 3 (6.0%) and 0 (0.0%) respectively. The difference in the proportion of fasciculation between drugs cisatracurium and rocuronium was statistically highly significant (P<0.0001)

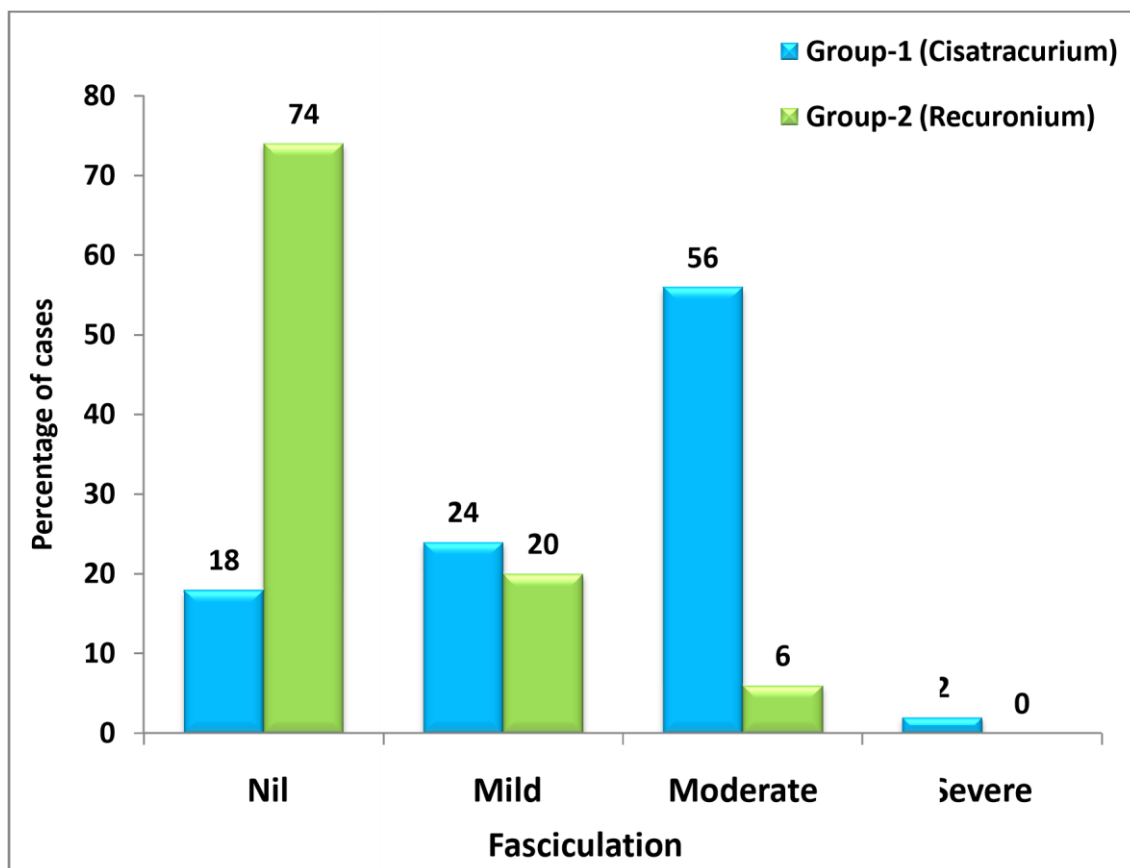


Figure 1: Multiple bar diagram represents comparison of fasciculation between cisatracurium and rocuronium

Table 4: Comparison of myalgia at PACU between cisatracurium and rocuronium

Variables	No. of cases	Nil	Mild	Moderate	Severe	Fisher exact test P-Value
		No. (%)	No. (%)	No. (%)	No. (%)	
Group-1 Cisatracurium	50	10 (20.0%)	28 (56.0%)	12 (24.0%)	0 (0.0%)	P =0.001 HS
Group-2 Rocuronium	50	39 (78.0%)	11 (22.0%)	0 (0.0%)	0 (0.0%)	

NS= not significant, S=significant, HS=highly significant

Among the cisatracurium group 28 (56.0%) had mild myalgia at PACU. The proportion of moderate & severe myalgia at PACU in cisatracurium group was 12 (24.0%) & 0 (0.0%) respectively. Among the rocuronium group 11 (22.0%) had mild myalgia and none of the patient had moderate and severe myalgia at PACU (table 16 & figure 17). The difference in the proportion of myalgia at PACU between drugs cisatracurium and rocuronium was statistically highly significant ($P < 0.001$).

Table No.5: Comparison of myalgia at 24 hours between cisatracurium and rocuronium

Variables	No. of cases	Nil	Mild	Moderate	Severe	Fisher exact test P-Value
		No. (%)	No. (%)	No. (%)	No. (%)	
Group-1 Cisatracurium	50	24 (48.0%)	25 (50.0%)	1 (2.0%)	0 (0.0%)	P =0.0001 HS
Group-2 Rocuronium	50	47 (94.0%)	3 (6.0%)	0 (0.0%)	0 (0.0%)	

NS= not significant, S=significant, HS=highly significant

The proportion of mild, moderate and severe myalgia at 24 hours in cisatracurium group-1 was 25 (50.0%), 1 (2.0%) and 0 (0.0%) respectively. Among the rocuronium group-2, 3 (6.0%) had mild myalgia at 24 hour (table 19 & figure 20). The difference in the proportion of myalgia at 24 hours between drugs cisatracurium and rocuronium was statistically highly significant ($P < 0.001$).

DISCUSSION

Succinylcholine is one of the most commonly used muscle relaxant in clinical practice because of its faster onset and excellent muscle relaxation which is suitable for intubation. However use of succinylcholine is not free of complications namely muscle fasciculations, post-operative myalgia, hyperkalemia, increased intraocular pressure and increased intracranial pressure. Pretreatment with several agents like rocuronium, atracurium, cisatracurium, propofol, thiopentone, magnesium sulphate prevent succinylcholine induced muscle fasciculations.^{7, 8}

Reduction in fasciculation

Comparing our study with True et al⁹ study which also says that rocuronium was superior in efficacy to cisatracurium in preventing succinylcholine induced fasciculation comparing to saline. The efficacy of this technique depends on the pretreatment dose and the interval between pretreatment dose and succinylcholine.¹⁰ With defasciculating dose of nondepolarising muscle relaxants, side effects may occur which include heavy eyelids, diplopia, difficulty swallowing, and generalized discomfort. Respiratory compromise and dyspnoea, although rare, may occur. These potential side effects are generally observed after a defasciculating dose that is >20% of the 95% effective dose (ED₉₅, or 10% of the standard intubating dose, which is 2 x ED₉₅).

Postoperative myalgia

Succinylcholine induced fasciculation and postoperative myalgia are a well-recognized side effect with the reported incidence of 95% and 50%, respectively.¹¹ Myalgia after the use of succinylcholine is most frequent on the first postoperative day.¹² Succinylcholine induced fasciculation is widely believed to be the primary cause of myalgia.¹³ The pretreatment with small (nonparalytic) doses of nondepolarising muscle relaxants prevents fasciculation intensity and muscle pain after succinylcholine administration. It is suggested that shearing forces associated with fasciculations produce damage to the delicate muscle spindles, which might result in postoperative myalgia.¹⁴ Kim et al¹⁵ study on optimal precurarising dose of rocuronium to decrease fasciculation and myalgia following succinylcholine administration shows precurarisation with 0.04 mg/kg rocuronium was the optimal dose considering the reduction in the incidence and severity of fasciculation ($p < 0.001$) and myalgia tends to decrease but there was no significance ($P = 0.072$).

In this study, incidence of post operative myalgia had decreased by pretreatment with sub paralysing doses of nondepolarising muscle relaxant rocuronium compared to cisatracurium, as the frequency of fasciculations were decreased.

CONCLUSION

From our study we conclude that rocuronium reduces succinylcholine induced muscle fasciculation and post operative myalgia more effectively in comparison with cisatracurium.

REFERENCES

1. Martyn JA, Fagerlund MJ, Eriksson LI. Basic principles neuromuscular transmission. *Anaesthesia* 2009;64:1-9.
2. Sine SM. End-plate acetylcholine receptor: structure, mechanism, pharmacology, and disease. *Physiol Rev* 2012; 92:1189-234.
3. Albuquerque EX, Pereira EF, Alkondon M, Rogers SW. Mammalian Nicotinic acetylcholine receptors: from structure to function. *Physiol Rev* 2009; 89:73-120
4. Lee S, Yang HS, Sasakawa T, Khan MA, Khatri A, Kaneki M, Jeevendra Martyn JA. Immobilisation with atrophy induces de novo expression of neuronal nicotinic $\alpha 7$ acetylcholine receptors in muscle contributing to neuro transmission. *Anesthesiology* 2014;120:76-85
5. Yamaoka K, Vogel SM, Seyama I. Na⁺ channel pharmacology and molecular mechanism of gating. *Curr Pharm Des.* 2006;12:429-42.
6. Nagashima M, Yasuhara S, Martyn JAJ. Train of Four and Tetanic fade are not always a prejunctional phenomenon as evaluated by toxins having highly specific pre and post junctional actions. *Anesth Analg* 2013;116:994-1000.
7. Musich J, Walts LF. Pulmonary aspiration after a priming dose of vecuronium. *Anesthesiology* 1986;64:517-9.
8. Shorten GD, Braude BM. Pulmonary aspiration of gastric contents after a priming dose of vecuronium. *Paediatr Anaesth* 1997;7:167-9.
9. True CA, Carter PJ. A comparison of tubocurarine, rocuronium and cisatracurium in the prevention and reduction of succinylcholine induced muscle fasciculation. *AANA J* 2003;71:23-28.
10. Fukano N, Suzuki T, Ishikawa K, Mizutani H, Saeki S, Ogawa S. A randomized trial to identify optimal precurarizing dose of rocuronium to avoid precurarization-induced neuromuscular block. *J Anesth* 2011;25:200-4.
11. Schreiber JU, Lysakowski C, Fuchs-Buder T, Tramèr MR. Prevention of succinylcholine induced fasciculation and myalgia: a meta-analysis of randomized trials. *Anesthesiology* 2005;103:877-84.
12. Smith I, Ding Y, White PF. Muscle pain after outpatient laparoscopy--influence of propofol versus thiopental and enflurane. *Anesth Analg* 1993;76:1181-4.

13. Laurence AS. Myalgia and biochemical changes following intermittent suxamethonium administration. Effects of alcuronium, lignocaine, midazolam and suxamethonium pretreatments on serum myoglobin, creatinine kinase and myalgia. *Anaesthesia* 1987;42:503-10.
14. Watters DJ, Mapleson WW. Suxamethonium pains: hypothesis and observation. *Anaesthesia* 1971;26:127-41.
15. Kim JH, Cho H, Lee HW, Lim HJ, Chang SH, Yoon SM. Comparison of rocuronium and vecuronium pretreatment for prevention of fasciculations. Myalgia and biochemical changes following succinylcholine administration. *Acta Anaesthesiol Sin* 1999;37:173-8.