



Comparative Study of Raise of Serum Creatine Phosphokinase Concentration and Urinary Myoglobin with Depolarizing Muscle Relaxant Succinylcholine and Precurarisation before Succinylcholine and Nondepolarizing Muscle Relaxant Vecuronium in Asa Grade – I Patients in Pediatric Age Group

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Received 03 June, 2016; Accepted 13 August, 2016 © The author(s) 2014. **Published** with open access at www.questjournals.org

ABSTRACT:

Introduction: The popularity of vecuronium in children is due to more rapid onset of action than in adults, where as the duration of action is the longest in infants and shortest in children and minimal residual paralysis is seen in post operative periods, without other complications that are encountered with succinylcholine.

Materials and Methods: All patients were divided into 3 groups randomly, Group-A, Group-B, and Group-C. Each group consists of 25 patients. Blood and Urine samples were sent for biochemistry lab before and after surgery for serum creatine phosphokinase and urinary myoglobin estimation and the results are tabulated.

Results: Post operative CPK levels were higher in all the three groups. Difference in the raise of serum Creatine phosphokinase levels in all the three groups which is statistically highly significant. Post operative urinary myoglobin was present in 100% of Group – A subjects, where as only 24% in Group – B and only traces in Group – C, and the difference is statistically highly significant.

Conclusion: whenever it is possible an alternative drug for succinylcholine has to be used to facilitate endotracheal intubation in pediatric age group because succinylcholine is producing severe skeletal muscle damage which is indicated by raised serum creatine phosphokinase level and presence of urinary myoglobin.

Keywords: Precurarization, Succinyl choline, Vecuronium.

I. INTRODUCTION

With succinylcholine and vecuronium introduction, knowledge of physiology of neuromuscular junction and reversal of its blockade, the technique of general anesthesia has become popular. Precurarization is defined as onset of non depolarizing muscle relaxant can be quickened by using either a larger dose or a priming dose.

Succinylcholine is a short-acting depolarizing-type, skeletal muscle relaxant for intravenous administration [1]. It has rapid onset of effect and ultra short duration of action permitted rapid sequence intubation [2], but its use is often accompanied by adverse effects like myalgias, masseter spasm, cardiac arrest, hyperkalemia, increase in myoglobin levels, increase in creatine phosphokinase levels in apparently healthy children. It is indicated as an adjunct to general anesthesia, to facilitate tracheal intubation [3], and to provide skeletal muscle relaxation during surgery or mechanical ventilation.

Creatine phosphokinase is an enzyme found primarily in the heart and skeletal muscle and to lesser extent in the brain [4]. Significant injury to any of these structures, will lead to a measurable increase in creatine phosphokinase levels.

Myoglobin is the O₂ binding protein of striated [cardiac / skeletal] muscle. After injury to skeletal muscle or cardiac muscle, myoglobin may be released and it is then excreted in the urine called as myoglobinuria. There are numerous causes of this condition.

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Nondepolarizing neuromuscular blocking agent like vecuronium is a monoquaternary amino steroid compound, commonly administered to children. It causes paralysis of the skeletal muscles by binding competitively to cholinergic receptors on motor endplate to antagonize action of acetylcholine, resulting in block of neuromuscular transmission. It is indicated as an adjunct to general anesthesia, to facilitate endotracheal intubation and to provide skeletal muscle relaxation during surgery or mechanical ventilation.

The popularity of this drug in children is due to more rapid onset of action than in adults, where as the duration of action is the longest in infants and shortest in children and minimal residual paralysis is seen in post operative periods, without other complications that are encountered with succinylcholine.

In view of the above advantages and disadvantages, and to know a relative safe muscle relaxant, a comparative study of succinylcholine and vecuronium is undertaken to compare the raise of serum creatine phosphokinase concentration and urinary myoglobin with succinylcholine and precurarization with vecuronium before succinylcholine and non- depolarizing muscle relaxant vecuronium in ASA Grade 1 patients in pediatric age group undergoing minor surgeries.

II. MATERIALS AND METHODS

A clinical prospective randomized study was undertaken to compare the raise of serum creatine phosphokinase concentration and urinary myoglobin with succinylcholine and precurarisation before succinylcholine and non depolarizing muscle relaxant (vecuronium) in ASA Grade – I patients in total of 75 Pediatric age group of both sexes, between 8-12 years, who were undergoing minor surgical procedures with minimal or no muscle damage at Government Medical College & Hospital, Ananthapuramu, Andhra Pradesh. Informed consent has taken from all the patients and ethical committee has approved.

Children with Family history of muscular dystrophy, Myopathies, History of unexplained high fever, Muscle cramps, Trauma, Muscle injury due to open surgery were excluded from this study.

They were divided into 3 groups randomly, Group-A, Group-B, and Group-C. Each group consists of 25 patients. Pre anaesthetic checkup was conducted and obtained detailed history.

Complete clinical examination was done and routine investigations were done. These patients were instructed to fast for a period of 6 hours prior to surgery. Urine and blood samples were sent to biochemistry lab for estimation of urinary myoglobin and serum creatine phosphokinase estimation respectively after patient was shifted to operation theatre. Patient vitals were recorded continuously during teh surgery.

After pre medications, Group–A Patients were induced with Inj. Thiopentone sodium 5mg/Kg and Inj. Succinylcholine 2mg/kg was used as an adjuvant to facilitate endotracheal intubation.

Group-B were induced with Inj. Thiopentone sodium 5 mg/Kg and precurarisation was done with 1/10th intubating dose of Inj. vecuronium, 60 seconds before induction and succinylcholine was used as an adjuvant to facilitate endotracheal intubation.

Group C patients were induced with Inj. Thiopentone sodium 5mg/kg and Inj vecuronium 0.1 mg/kg was used to facilitate endotracheal intubation.

Again 10 to 15 ml of urine sample was collected in all the three groups for urinary myoglobin estimation, 20 minutes after intubation. 20 to 24 hours after the surgery 2 ml of blood is collected in a plain bottle and sent for biochemistry lab for serum creatine phosphokinase estimation and the results are tabulated.

Urinary Myoglobin was estimated by colorimetric method and Serum Creatine Phosphokinase was estimated by Nephelometric method.

2.1.Statistical Analysis

In the present study, the parameters were recorded and data was entered into the statistical package for social sciences (SPSS 14.0). Statistical analysis were done by using paired – samples ‘T’ test. Probability values less than 0.001 were considered as statistically significant.

III. RESULTS

Three groups were studied with 25 patients in each group. Group A - Succinyl choline, Group – B : Precurarization with Vecuronium, Group – C : Vecuronium, Serum creatine phosphokinase and Urinary myoglobin were studied among all these groups and their difference between the groups were estimated.

Males were predominant in all the three groups. Around 73% males and 27% females were underwent surgeries (Fig.1).

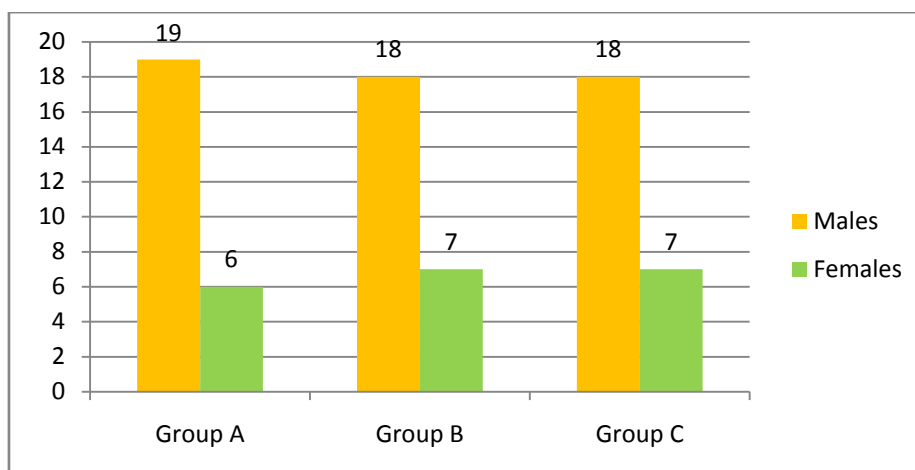


Fig.1 : Gender wise Distribution of Study Subjects

Children aged about 8 and 10 years were maximum in Group – A that is about 24% where as in Group – B maximum children were in the age of 9 years and in Group – C maximum children were in the age of 10 years (Table No.1). This table shows age distribution of all the 3 group children which is comparable and statistically insignificant.

Table 1 : Distribution of Study Subjects according to Age

Age in years	Group – A Succinylcholine		Group – B Precurarization with Vecuronium		Group – C Vecuronium	
	No. of persons	Percentage	No. of persons	Percentage	No. of persons	Percentage
8	6	24	7	28	6	24
9	4	16	3	12	1	4
10	6	24	9	36	11	44
11	5	20	1	4	4	16
12	4	16	5	20	3	12
	25	100%	25	100%	25	100%
Mean age	9.88		9.76		9.88	

Distribution of various minor surgeries underwent by all the three groups were tabulated in Table No.2

Table No.2 Distribution of different minor surgeries done among three groups

Sl. No.	Surgical Condition	No. of Patients		
		Group – A Succinylcholine	Group – B Pre curarization with Vecuronium	Group – C Vecuronium
1.	Circumcision	2	4	4
2.	Urethroplasty	5	4	1
3.	Laprosopic Appendicectomy	10	1	5
4.	Open Appendicectomy	1	2	4
5.	High Ligation of Sac	0	0	3
6.	Herniotomy / Hernioplasty	6	13	6
7.	Orchidopexy	1	1	2
	Total	25	25	25

Pre and postoperative serum CPK levels were estimated and the Post opertaive CPK levels were higher in all the three groups. Difference in the raise of serum Creatine phosphokinase levels in all the three groups which is statistically highly significant (Table No.3)

Table No.3 Difference in the raise of Serum Creatine Phosphokinase Levels in all the three groups.

Parameters	Group – A Succinylcholine	Group – B Precurarization with Vecuronium	Group – C Vecuronium
Pre Operative	52.97	45.88	46.08
Post Operative	276.04	151.6	60.24
Mean (Difference)	223.12	107.08	14.08
Standard Deviation	43.41	27.57	12.54

'P' value in between all the three groups was less than 0.001.

Post operative urinary myoglobin was present in 100% of Group – A subjects, where as only 24% in Group – B and only traces in Group – C, and the difference is statistically highly significant (Table No.4).

Table No.4 Difference in the Urinary Myoglobin Level changes in percentage in all the three groups

Groups	Urinary Myoglobin Present		Urinary Myoglobin Absent		Urinary Myoglobin Traces	
	Total No. of Cases	No. of Cases & Percentage	Total No. of Cases	No. of Cases & Percentage	Total No. of Cases	No. of Cases & Percentage
Group – A Succinylcholine	25	25 (100%)	25	Nil (0%)	25	Nil (0%)
Group – B Precurarization with Vecuronium	25	6 (24%)	25	16 (64%)	25	3 (12%)
Group – C Vecuronium	25	Nil (0%)	25	24 (96%)	25	1 (4%)

IV. DISCUSSION

Recent advancement in medical system and introduction of newer muscle relaxants have changed scenario of general anesthesia. Both the depolarizing and non depolarizing muscle relaxants have their own uniqueness in administration with fewer side effects.

To decrease the adverse effects of succinylcholine like postoperative myalgia, fasciculations, skeletal muscle damage, raised serum creatine phosphokinase levels and urinary myoglobin levels one of the most useful method is the administration of subparalysing dose of nondepolarizing muscle relaxant 2 to 4 minutes before administration of succinylcholine.

M.A. Yousef et al [5] have studied that creatine phosphokinase levels are increased in both minor and major surgical procedures. The raise was significantly high with major surgical procedures than in minor surgical procedures.

Waters et al [6] in their study have shown that there is a raise in creatine phosphokinase levels due to shearing of soft tissues due to unsynchronized contractions of adjacent muscle fibers just before the onset of paralysis. This damage to muscle has been substantiated and increase in creatine phosphokinase.

Ozilio et al [7] have studied the administration of Rocuronium before Succinylcholine and studied the effects on muscle derived enzymes and myoglobins. In present study we have selected vecuronium as a priming drug and found that there is significant raise in serum creatine phosphokinase when compared with succinylcholine group and urinary myoglobins also significantly found in all the cases of Group B and Group C

A study was done by Munshi et al [8] concluded that vecuronium has rapid onset of action, better agent in facilitating rapid intubation in pediatric patients when compared to pancuronium. Cardiovascular stability, lack of histamine release, ease of supplementation and ease of reversal make vecuronium more suitable agent for use in pediatric anaesthesia as compared to pancuronium.

Indu M. Sen et al [9] have studied different doses of Succinylcholine on post operative myalgia and compared the intubating conditions and creatine phosphokinase levels. He has given different doses of succinylcholine and found that post operative myalgia was less with 2.5 mg / kg of succinylcholine group and intubation conditions were significantly better with 1.5 mg / kg and 2.5 mg / kg groups, creatine phosphokinase levels were higher after 24 hours with 2.5 mg / kg Succinylcholine group. In present study we have not compared intubating conditions. We compared only serum creatine phosphokinase levels after 24 hours of giving 2 mg/kg Succinylcholine, being the best dose for intubation and Precurarization group and vecuronium group and found that highly significant raise in succinylcholine group when compared to other groups.

Noguchi et al [10,11] has studied the effects of succinylcholine on serum levels of myoglobin and creatine phosphokinase levels in children under halothane (or) enflurane anaesthesia and the results indicated that there was an increase in myoglobin and creatine phosphokinase levels with succinylcholine and this might play some role in development of malignant hyperthermia.

A. Kudoh et al [12] compared increase in serum creatine phosphokinase concentration after suxamethonium during sevoflurane and isoflurane anaesthesia in children and they concluded that administration of suxamethonium during either sevoflurane or isoflurane anaesthesia caused a marked increase in serum creatine phosphokinase concentration in pediatric patients. In present study we have not included the effects of inhalational anaesthetics. We found that there is marked raise of serum creatine phosphokinase levels in succinylcholine group.

V. CONCLUSION

There was raise in serum concentration of creatine phosphokinase levels in all the three groups. The raise of serum creatine phosphokinase level was significantly high with succinylcholine group when comparing with other groups and was insignificant with Precurarization group and vecuronium group. Urinary myoglobin is present in all the patients in succinylcholine group which was highly significant. Urinary myoglobin was

present only in minimal number of patients in group B and completely absent in group C patients which was statistically insignificant. When vecuronium is used for endotracheal intubation raise of serum creatine phosphokinase and urinary myoglobin levels was not very significant.

So whenever it is possible an alternative drug for succinylcholine has to be used to facilitate endotracheal intubation in pediatric age group because succinylcholine is producing severe skeletal muscle damage which is indicated by raised serum creatine phosphokinase level and presence of urinary myoglobin. In case succinylcholine administration is desirable then precurarization has to be done.

ACKNOWLEDGEMENTS

We would like to express our gratitude towards staff of Department of Anesthesia for helping us while doing this study.

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