

Original Research Article

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Rocuronium for intubation in parturients undergoing caesarean section

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ABSTRACT

Background: Anaesthetic management of a parturient is a challenge because it involves simultaneous care of both mother and baby. Succinylcholine, a depolarizing muscle relaxant is most commonly used and considered “The Gold Standard” for tracheal intubation. Among currently available non-depolarizing neuromuscular blocking agent rocuronium bromide is the only agent that has rapid onset of action which is comparable to succinylcholine. Thus, rocuronium may provide alternative to succinylcholine for rapid sequence induction of anaesthesia wherever succinylcholine is contraindicated.

Methods: In a control trial, 60 parturients of ASA grade I and II were randomly allocated in two groups of 30 patients each (group R and group S). After preoxygenation for a period of 5 minutes rapid sequence induction done with thiopentone 5mg/kg for all patients. Muscle relaxant rocuronium (0.6mg/kg) was administered for group R. Succinylcholine was given in similar dosage (0.6mg/kg) for group S. The intubation was tried after 90 seconds in group R (rocuronium group) but after 60 seconds in group S (succinylcholine group). The intubating conditions were assessed and compared among the groups using criteria suggested by Cooper et al.

Results: The mean intubation time was 98.3 seconds in group R and 67.9 seconds in group S. Rocuronium produced clinically acceptable intubating conditions in 28 out of 30 patients (93.33%). Among these 28 patients 70% had excellent intubating conditions and 23.33% had good intubating conditions. Clinically acceptable intubating conditions were present in all 30 patients (100%-90% excellent and 10% good) who were administered succinylcholine. Succinylcholine produced excellent intubating conditions at 60 seconds (90 percent) compared to rocuronium (70 percent). However, this difference was statistically insignificant ($p= 0.053$). The mean Apgar score at 1 min and 5 min in group R was 8.1 and 8.83 as against 8.06 and 8.96 in babies born to mother in group S.

Conclusions: Rocuronium (0.6mg/kg) provided acceptable intubation conditions after a waiting period of 90 seconds in 93.33% patients as against 100% patients in succinylcholine administered patients in equivalent dosage. So rocuronium is a promising alternative for rapid sequence induction in parturients in whom succinylcholine is not advisable or contraindicated.

Keywords: Endotracheal intubation, Intubation score, Laryngoscopy, Parturients, Rocuronium, Rapid sequence intubation, Succinylcholine

INTRODUCTION

Anaesthetic management of a parturient is a challenge because it involves simultaneous care of both mother and baby. Failure to appropriately manage endotracheal

intubation increases the risk of hypoxic cardiopulmonary arrest and/or pulmonary aspiration, resulting in a high probability of maternal morbidity and mortality. Anatomic and physiologic changes during pregnancy place the parturient at increased risk for airway related problems. Although the use of general anaesthesia has been declining in obstetric patients, it may still be required in some cases¹. Good intubating conditions minimize the risk of trauma associated with tracheal intubation. Intubating condition depends on anaesthetic depth and kind of anaesthetic and muscle relaxant used.

Succinylcholine, a depolarizing muscle relaxant is most commonly used and considered "The Gold Standard" for tracheal intubation. Succinylcholine has certain side effects and is inadvisable in some conditions like susceptibility to hyperpyrexia, abnormal cholinesterase genotypes, susceptibility to hyperkalemia. One of the main reasons for the popularity of succinylcholine is its propensity to create good intubating conditions rapidly. This increases safety, since it allows early establishment of patent airway, reducing the risk of aspiration.²

With the advent of newer, non depolarising muscle relaxants, anaesthetist have the luxury of other options where succinylcholine is contraindicated. Rocuronium bromide, a newer amino steroid non depolarizing muscle relaxant is indeed a step forward in the development of safer and faster acting neuromuscular blocking agents.³

Among currently available non depolarizing neuromuscular blocking agent rocuronium bromide is the only agent that has rapid onset of action which is comparable to succinylcholine. Thus, rocuronium may provide alternative to succinylcholine for rapid sequence induction of anaesthesia wherever succinylcholine is contraindicated. When rocuronium is used in non pregnant patients adequate intubating conditions were achieved in 60-90sec, a desirable feature when rapid sequence induction is required as in case of caesarean section.⁴

Hence the present study was undertaken to compare the intubating conditions in parturients undergoing caesarean section with rocuronium 0.6mg/kg body weight with that of traditional succinylcholine 0.6mg/kg body weight after 90s and 60s respectively and its effects on mother and fetus.

This study aims to study the intubating conditions in parturients undergoing caesarean section with twice ED95- 0.6mg/kg dose of rocuronium and comparing it with the gold standard drug succinylcholine in similar dosage.

METHODS

A prospective randomized control trial was conducted in the department of anaesthesiology at authors' medical

college and hospital. This investigation was approved by institutional ethical committee and written informed consent was obtained from all parturients. Total sixty parturients of ASA physical status I or II undergoing elective cesarean section were included in the study. Patients with anticipatory difficult intubation, Pregnancy Induced Hypertension, foetal distress, toxæmia of pregnancy, patients who received Magnesium Sulphate, gross obesity were excluded from the study. All patients entering the study were subjected to a detailed pre-anaesthetic evaluation prior night and their body weight was recorded. Patients received famotidine 40mg orally on the previous night of surgery.

In the operation theatre, NPO status was confirmed and standard multipara monitor with non-invasive blood pressure, electrocardiogram and pulse oximeter were applied to the patient and baseline parameters like pulse rate, blood pressure was recorded, and IV line was secured.

Patients were randomly distributed in two groups of 30 patients each. The randomization was done by doing the computerized chits and selecting one of them blindly. Rocuronium and succinylcholine were used as muscle relaxant in group R and group S respectively. All patients were premedicated with ondansetron 4/8mg and preoxygenated with 100% oxygen using properly fitting face mask via Bain's circuit for a period of five minutes. Patients in both groups were induced with thiopentone 5mg/kg followed by muscle relaxant. IPPV was intentionally avoided, when patient went into apnea. The intubation was tried after 90seconds in group R with 0.6mg/kg rocuronium and after 60seconds in group S with 0.6mg/kg succinylcholine.

Anaesthesia was maintained on O₂:N₂O 50:50, sevoflurane 0.6 to 1% till extraction of baby, then after extraction of baby O₂:N₂O 1:2. Intra Venous pentazocine 15 mg and midazolam 1 mg were given in both the groups for sedation. Supplemental dose of muscle relaxant in group R with rocuronium 0.1mg/kg was given as per need whereas vecuronium 0.05mg/kg was given to group S and it was continued with relaxation dose of 0.02mg/kg as and when needed.⁵

Table 1: Criteria used to calculate intubation score.

Score	Jaw relaxation	Vocal cords	Response to intubation
0	Poor (impossible)	Closed	Severe coughing /Bucking
1	Minimal (difficult)	Closing	Mild coughing
2	Moderate (fair)	Moving	Slight diaphragmatic movements
3	Good (easy)	Open	None

Total score: 9

Intubating conditions were assessed and recorded in each patient. Authors adopted the criteria of Cooper et al, as shown in Table 1.⁶ The final intubation score was calculated after taking into account the score of each variable. The total score in a given patient was then used for grading the intubating conditions. A score of 8 and 9 was taken as excellent, score of 6 and 7 as good, score of 4 and 5 fair and lower score of 1, 2 and 3 as poor.

Neonatal outcome was assessed by Apgar score at 1 minute and 5 minutes. Side effects and complications were monitored in intra operative and immediate post-operative period like hypotension and bradycardia, skin erythema, uterine atony, prolonged apnea, delayed recovery of muscle tone, PONV. Reversal of neuromuscular block was done at the end of surgery with neostigmine 0.05mg/kg and glycopyrrolate 10 μ g/kg.

Statistical analysis

Statistical software STATA version 13.1 was used for statistical analysis. Continuous variables (age, weight, intubation time, duration of action, apgar score) were presented as mean \pm SD. Categorical variables (intubation score) are presented in actual numbers and percentage and compared by Pearson's chi-square test. For small numbers Fisher's exact test is applied. Haemodynamic parameters were compared at different time point in each group by performing one-way repeated measure ANOVA. Changes in haemodynamic parameters were compared between two groups at different time point from baseline by performing unpaired t test for normalized data and Mann-Whitney U test was used for non-normalized data. P-value less than 0.05 were considered as statistically significant

RESULTS

There was no statistically significant difference between group R and group S with regard to age and body weight. The mean ages in group R and group S were 25.5 \pm 3.73 years and 25.83 \pm 3.09 years respectively and mean body weights were 55.6 \pm 8.26kg and 53.23 \pm 0.81kg, respectively. The baseline hemodynamic parameters were comparable in both groups (Table 2).

Table 2: Observed intubation score.

Grade	Score	Group R (no. of pts)	Group S (no. of pts)	P value R vs S
Poor	1, 2 and 3	-	-	-
Fair	4	-	0.492,	NS
	5	2 (6.7%)	-	
Good	6	3 (10%)	-	0.087, NS
	7	4 (13.3%)	3 (10%)	
Excellent	8	16 (53.3%)	9 (30%)	0.053, NS
	9	5 (16.7%)	18 (60%)	

Table 3: Intubation grades.

Grade	Intubation score	Group R (No. of pts)	Group S (No. of pts)
Poor	1, 2 and 3	-	-
Fair	4 and 5	2	-
Good	6 and 7	7	3
Excellent	8 and 9	21	27

Rocuronium produced clinically acceptable intubating conditions in 28 out 30 patients (93.33% - 70% excellent and 23.33% good) at 90 seconds following administration of drug. Clinically acceptable intubating conditions were present in all 30 patients (100%-90% excellent and 10% good) who were administered succinylcholine at 60 seconds. But succinylcholine produced better intubating conditions at 60 seconds (90 percent) when compared to rocuronium (70 percent), however this difference was statistically insignificant with p-value 0.053. Two patients (6.66%) in the rocuronium group at 90 seconds had less than acceptable intubating conditions. Their score was only 5 and it was graded as fair intubating condition. Authors did not find vigorous bucking over the tube in any patients of rocuronium group (Table 3).

Table 4: Intubation time (Sec).

Intubation time (secs)	Group R (No. of pts)	Group S (No. of pts)
60-70	0	30
71-80	0	0
90-100	26	0
101-110	4	0
Mean intubation time (seconds)	98.33 \pm 2.53	67.9 \pm 0.84
p-value	<0.0001, HS	

Intubation time taken as the time interval from end of Rocuronium/Succinylcholine injection to actual insertion of ETT through glottis was found to be between 95 to 106 seconds in group R with mean time of 98.3 sec and between 66 to 70 seconds in group S with mean time of 67.9 sec, the difference being statistically highly significant with p-value <0.0001 as shown in Table 4.

Apgar score

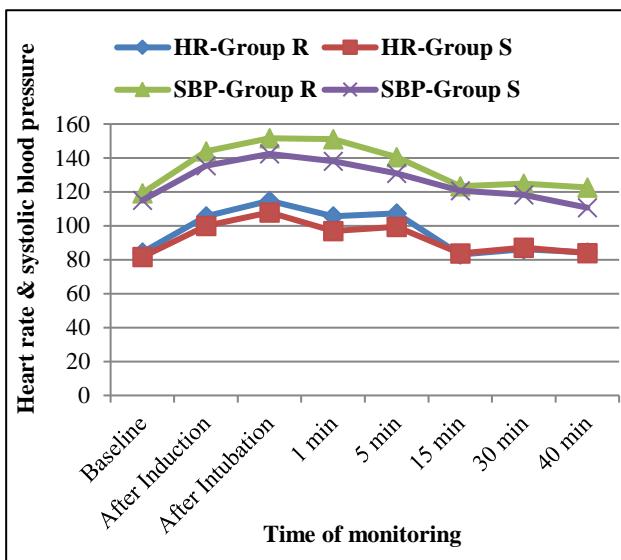
Neonatal condition was uniformly good in the two groups. At 1 and 5 minutes, the Apgar scores were more than 7 in both the groups. The Apgar score at one minute and five minutes was comparable in both the groups. There was no significant difference between the two groups (Table 5).

The increase in mean pulse rate and mean systolic pressure were found to attain maximum levels immediately after intubation in patients which was found highly statistically significant s compared to their baseline levels in both groups independently.

Table 5: Comparison of Apgar score.

Apgar score	Group R	Group S	P-value
1 min	8.1±0.60	8.06±0.58	0.8291, NS
5 min	8.83±0.38	8.96 ±0.18	0.0879, NS

Subsequently both these parameters steadily decreased in similar manner in both the groups. Although statistically significant increase in heart rate and systolic blood pressure was observed in group R just after induction, intubation coinciding with skin incision lasting for five to ten minutes in comparison to group S which was clinically non-significant, by 15minutes it normalized to baseline (Figure 1).

**Figure 1: Comparison of heart rate (HR) and systolic blood pressure (SBP) in between group R and group S.**

The duration of action of rocuronium was in range of 25-80 minutes whereas succinylcholine was in range of 7-15 minutes. There were two cases in group R in which prolonged period of apnea even after completion of surgery was observed.

The post-operative vitals were clinically comparable with their baseline values

DISCUSSION

Rocuronium has been used for rapid sequence intubation and is reported to provide conditions similar to that offered by succinylcholine. Rocuronium is a drug with quick onset because of its low potency (ED95-0.3mg/kg-1).^{7,8} Onset time of a neuromuscular blocker is considered important because it serves as a predictive parameter for the rate of development of ideal intubating conditions.

As per the literature review and keeping different reports in mind, authors selected minimal effective dose of rocuronium i.e. 0.6mg/kg required to obtain good to excellent intubating condition which will have minimal placental transfer, without potential risk of neonatal depression.⁹⁻¹³ Also, the surgeries being of comparatively shorter duration (35-50minutes) higher doses were avoided to avoid prolonged duration of action. As present study population was females so being more sensitive to rocuronium, the higher drug dosage (greater than 0.6mg/kg) were not selected.

Authors did not use any neuromuscular monitoring to assess vocal cord paralysis but selected the cut off time of 90 seconds after administration of rocuronium and 60 seconds time interval in succinylcholine group to start laryngoscopy and intubation.^{6,11,14-17} As optimum intubating conditions is achieved not only by choosing the appropriate dose of relaxant but also depends upon the time allowance to manifest its action optimally. Authors deliberately allowed a waiting period of 90seconds before commencement of laryngoscopy in rocuronium group to optimize intubating condition.

In present study it was ensured that all patients were preoxygenated with 100% oxygen using properly fitting face mask via Bain's circuit for a period of five minutes before starting induction with intravenous thiopentone. This was undertaken to ensure that in none of the patients SpO₂ levels drop during the waiting period of 60seconds (in S group) or 90sec (in R group) period wherein no attempts were made to ventilate the patient.

Authors used criteria of Cooper et al for assessing intubating conditions scale whose basis is the assumption that "excellent" and "good" intubating conditions can be considered as clinically acceptable and "fair" and "poor" condition as clinically unacceptable.⁶

Rocuronium produced clinically acceptable intubating conditions in 28 out 30 patients (93.33%-70% excellent and 23.33% good) at 90seconds whereas in succinylcholine clinically acceptable intubating conditions were present in all 30 patients (100%-90% excellent and 10% good) at 60seconds. But succinylcholine produced significantly more excellent intubating conditions at 60seconds (90%) when compared to rocuronium (70%) however this difference was statistically insignificant with p-value 0.053. Two patients (6.66%) in the rocuronium group at 90seconds had less than acceptable intubating conditions. Their score was only 5 and it was graded as fair intubating condition. In two patients of rocuronium group peripheral limb movements were seen at the time of intubation and these were considered clinically insignificant. In another three patients of same group diaphragmatic activities were evident after intubation but these subsided quickly. Authors did not find vigorous bucking over the tube in any patients of rocuronium group. Present study findings

are comparable to those obtained in a study conducted by Abouleish et al, Shukla et al, Devi U et al, Ali et al.^{5,11,18}

The mean intubation time i.e. the time after injection of muscle relaxant till the ETT inserted though glottis, was significantly longer for rocuronium because authors deliberately waited for 90seconds before commencement of laryngoscopy because of reasons discussed above, the mean value being 98.3seconds for rocuronium and 67.9seconds for succinylcholine. If authors take into consideration the waiting period of 90seconds (group R) and 60seconds (group S), authors can say that the actual process of laryngoscopy and lubricated endotracheal tube insertion was swiftly accomplished in all the patients of our study.

In neonatal considerations, induction- delivery intervals ranged from 5 to 15minutes and uterine incision - extraction intervals were within 90seconds in all patients in both groups' exception one patient from group R where it took 180seconds because of previous surgery adhesions. No adverse effect noted in the new born. Neonatal outcome was monitored by Apgar score at 1 min and 5min. All the babies in either group were crying and doing well in early neonatal life. The mean Apgar score at 1 minute and 5minutes in Rocuronium group was 8.1 and 8.83 as against 8.06 and 8.96 in babies born to mother in group S. The Apgar scores were comparable in the two groups.

The mean pulse rate and mean systolic pressure were found to attain maximum levels immediately after intubation in patients of both the groups. Subsequently both these parameters steadily decreased in similar manner in both the groups. The increase in mean pulse rate and systolic blood pressure was statistically significant p-value (<0.05) for period upto five minutes in both the groups. The surgical exploration, extraction of fetus, ensuing blood loss through uterine incision, contraction of uterus all these crucial factors are operating sequentially and/or simultaneously in the initial 10-15minutes in caesarean section. The record of mean heart rate and systolic blood pressure were found near basal level at 15minutes stage. Subsequently intraoperative vital parameter recorded normal and comparable in the two groups. There was no episode of hypotension or bradycardia in any patient. Intraoperatively patients were mostly given crystalloid solutions and blood was administered only when the surgical blood loss was significant.

In present study just before reversal, all patients were administered intramuscular injection diclofenac for providing postoperative pain relief. The antagonism of rocuronium/ vecuronium muscle relaxants was easily accomplished in all patients except two cases in rocuronium as stated earlier. The postoperative pulse rate and blood pressure were recorded, and these were found to be normal and almost same as baseline levels. All the patients in both the groups were administered oxygen

therapy through venti mask before discharge to their respective wards. During this observation period none of the patients had any episodes of nausea and vomiting.

A limitation of present study was the absence of blinding. Rapid sequence intubation being a high-risk procedure especially in caesarean section, due to considerations of optimal patient safety in our setup, a conscious decision was made not blind the study. Also, neuromuscular monitoring of corrugator supercilii muscle in the study could perhaps have shed additional light on timing the optimum conditions for tracheal intubation in the two study groups as current best evidence suggests that the corrugator supercilii reflects laryngeal relaxation better than monitoring of adductor pollicis.

From the observations of the present study, authors conclude that 0.6mg/kg rocuronium following induction with thiopentone 5mg/kg in patients undergoing caesarean section was found to provide acceptable intubating condition after a waiting period of 90 seconds in 93.33% patients as against 100% patients in succinylcholine administered patients in equivalent dosage. However, the latter drug was superior in achieving excellent intubating condition in 90% as against only 70% found with rocuronium.

So rocuronium is a very promising alternative for rapid sequence induction in parturients in whom succinylcholine is not advisable or contraindicated. Further studies should be done with higher dosage of rocuronium as intubating dose to validate its neonatal safety and to attain excellent intubating conditions in all 100% of the patients. Also, another induction agent like propofol can be utilized instead of thiopentone to achieve desired goal of best intubating conditions in a given obstetric patient.

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