

Rocuronium for Rapid Sequence Induction in Elective Caesarean Section

Mohammed Husam Nafie

Department of Anesthesia, Rizgary Teaching Hospital and Zheen International Hospital, Kurdistan, Iraq.

Abstract- Background: Rocuronium with its rapid onset of action is one of the most commonly used safe and effective muscle relaxants for intubation and maintenance of muscle relaxation during surgical procedures.

Objective: To demonstrate the safety and efficiency of rocuronium for rapid sequence induction in caesarean section. **Methods:** This prospective observational study was conducted on 75 pregnant women (17–48 years of age) undergone elective caesarean section between November 2014 and June 2015, after preoxygenation, rapid sequence induction started with rocuronium 0.6 mg/kg where 25% of the dose given just before thiopentone and the rest of the dose thereafter. Patients were intubated, mechanically ventilated and anesthesia maintained with isoflurane and air in oxygen. The vital signs of the patient monitored. The newborn babies were received by a pediatrician and evaluated at 1 and 5 min APGAR scores. The condition of the tracheal intubation evaluated by the intubator. **Results:** Rocuronium used for rapid sequence intubation provided satisfactory intubating conditions, with intraoperative hemodynamic stabilization and no aspiration related complications. The mothers and the new born babies had shown no serious side effects.

Conclusion: Rocuronium is safe and effective for rapid sequence intubation and maintenance of muscle relaxation during elective caesarean section.

Index Terms- Anesthesia, Caesarean section, Rapid sequence induction, Rocuronium.

I. INTRODUCTION

According to a statement from world health organization Caesarean section is one of the most common surgeries in the world, with rates continuing to rise beyond the ideal rate of 10-15% that was recommended by the international health care [1]. The highest rate (29.2%) is seen in Latin America and the Caribbean countries, the proportion of caesarean births is 21.1% in developed countries [2]. In Iraq, according to the Iraq Multiple Indicator Cluster Survey 2006 (Iraq MICS 2006) about 20% of births were delivered by caesarean section and 17.6% in Kurdistan-Iraq Region [3].

Caesarean section can be associated with significant morbidity and mortality, despite the decline in anesthesia-related maternal mortality during the past few decades, it still accounts for 3% to 12% of maternal deaths, with the majority secondary to failures in intubation, ventilation, and pulmonary aspiration during general anesthesia [4,5].

All obstetric patients are considered to have a full stomach and to be at risk for pulmonary aspiration, the higher incidence of failed intubations in pregnant patients may be due to airway oedema, a full dentition, or large breasts that can obstruct the handle of the laryngoscope in patients with short necks in addition to weight gain [6,7]. Therefore, there is need to adapt certain difficult airway algorithm to assure save and rapid sequence intubation and avoiding pulmonary aspiration. The use of rapid sequence induction with use of thiopental and suxamethonium has remained standard and largely unchanged for the last four to five decades [8], but the administration of suxamethonium is associated with a wide spectrum of side-effects, some of which are very serious, and it is contraindicated in some patients. It is associated with muscle pains, hyperkalaemia, increase in intraocular, intragastric, and intracranial pressures, allergic reactions, and malignant hyperthermia which is associated with considerable mortality [9]. Among non-depolarizing muscle relaxant, rocuronium a monoquaternary amine has a very rapid onset of action . In a dose of 0.6 mg kg^{-1} , acceptable intubating conditions are usually achieved within 60-90s [10], and these are comparable with suxamethonium [11]. Most of the drug is excreted unchanged in the urine and bile, causes no hemodynamic changes (blood pressure, heart rate, or ECG) with duration of action 30-40 minute. However the advent of sugammadex might make suxamethonium some-what obsolete for intubation as in doses 8-16mg/kg it can reverse blocking effect of rocuronium as early as 3 minutes [12].

In this prospective observational study we tried to evaluate safety and efficacy of rocuronium during elective cesarean section in a tertiary care center in Kurdistan-Iraq. We evaluated the overall intra and postoperative clinical outcome of mother and newborn.

II. MATERIALS AND METHODS

The proposed study was carried out at Department of Gynecology and Obstetrics, Zheen International Hospital, Kurdistan Iraq, after obtaining permission from the Institutional Ethics Committee/ Institutional review Board of the hospital. Written consent of the procedure was taken from all patients. The observed data was recorded in the patient's information sheet.

The study population consisted of 75 pregnant patients undergoing elective cesarean section between November 2014 and June 2015.

All pregnant patients with diseases as neuromuscular diseases or receiving drugs that may interfere with neuromuscular blocking agents, and those patients where

difficult intubation may be anticipated were excluded from the study.

The surgical procedure followed was as per the protocol of Department. The patients were pre-oxygenated with 100% O₂ for 3 minutes after securing venous access with a wide bore cannula in one of the large veins on the dorsum of the hand, lactated Ringer's solution was started. When the surgeon was ready, a rapid-sequence induction with cricoid pressure was performed with rocuronium 0.6 mg/kg where 25% of the dose given just before thiopentone 6–7 mg/kg and the rest of the dose after loss of consciousness, which was determined by the loss of eyelash reflexes. Patients intubated with 7 mm ID endotracheal tube, mechanically ventilated and anesthesia maintained with isoflurane 1% and 50% air in oxygen. Heart rate, ECG, non-invasive blood pressure, oxygen saturation and end-tidal CO₂ were monitored in all patients throughout the procedure. Tracheal intubation was carried out by a senior anesthetist within 60 seconds from finishing the muscle relaxant administration. Intubation was assessed by the intubator using a modified system used by Viby-Mogenson et al, which included Jaw relaxation, position of the vocal cords, and diaphragmatic movement [13]. (Table 1)

Each one of these variables was assigned to a value from the list, and the intubating conditions were classified as excellent, good, or poor. Intubating conditions classified according to the worst variable so that intubation was considered excellent if all variables were excellent, if one of the variables was good then the intubation conditions were considered good, if one of the variables was poor then intubation conditions were considered poor.

Table 1: Modified Viby-Mogenson Grading system for intubation

Criteria	Excellent	Good	Poor
Jaw Relaxation	Relaxed	Relaxed	Poor relaxation
Vocal cord position	Abducted	Intermediate	Closed
Diaphragmatic activity	None	Diaphragm only	Sustained coughing

The babies were received by a pediatrician and evaluated by 1 and 5 min APGAR scores. All mothers received oxytocin, metoclopramide, fentanyl 1-1.5 μ g/kg, and paracetamol, and at the end of the procedure muscle relaxation was reversed with neostigmine and atropine in 2.5:1 ratio. The patients were extubated, evaluated and transferred to the recovery room, later discharged to the ward when fully conscious with adequate spontaneous breathing and stable hemodynamics.

III. RESULTS

All patients were pregnant females admitted in the Department of Gynecology and Obstetrics and had undergone elective cesarean section. The mean ages of patients were 28.96

\pm 5.95 years. The characteristics about patient demographics, inducing agents, muscle relaxants, and procedures used are summarized in Table 2.

Table 2: Characteristics of study subjects and drugs

Characteristics	Average	Range
Mean Age	28.96 \pm 5.95 years	17-48 years
Intubating dose of rocuronium	36.53 \pm 2.46 mg	30-40 mg
Dose of thiopentone	485.53 \pm 60.88 mg	400-550 mg
Time to intubation	<60 sec	-
Procedure time	33.83 \pm 6.71 min	20-60 min

Patients were found to have acceptable intubating conditions with use of rocuronium, the condition was excellent in 69 patients (92%), good in 5 cases (6.65%), and poor in only 1 case (1.35%). (Table 3).

Table 3: Intubating conditions

Intubating conditions	Number of cases (%)
Excellent	69 (92)
Good	5 (6.65)
Poor	1 (1.35)

Three episodes of minor side effects were noted in the mothers during this study. One case showed transient and mild increase in pulse rate and blood pressure during intubation, temporary urticaria at site of injection of rocuronium and thiopentone noted in another case, while there was only one case of postoperative nausea. All babies delivered within 5 minutes of induction. There were 3 premature babies, and 2 preterm and 2 preterm twins. All babies were in good condition and there was no evidence of any congenital abnormality. APGAR score in 1 minute was 4 only in one case and the rest of the cases the score was from 6 to 9. The APGAR score at 5 minutes was from 7 to 10.

IV. DISCUSSION

Rapid sequence induction procedure carried out in caesarean section surgeries because all parturient are regarded as full stomach patients, protection of the airway is of utmost important and requires use of a rapid onset and efficient muscle relaxant.

We studied intubating conditions in patients undergoing elective cesarean section after giving rocuronium 0.6 mg/kg along with thiopentone 6-7 mg/kg as an induction agent.

Anesthetists were able to intubate the patients easily with 7 mm ID endotracheal tube at the first attempt within 60 seconds, and the intubating conditions was satisfactory, with 69 cases had excellent intubating condition, 5 had good conditions, and only one case the condition was not very poor but the dose of rocuronium was increased. Duration of the entire procedures lasted from 25 to 60 minutes, with only 6 cases lasted more than

35 minutes and needed a top up dose of rocuronium. Only 6 cases needed an additional small dose of propofol. There were no significant changes in pulse rate or blood pressure (except for one case), no arrhythmias. Very few incidences of adverse events were seen in mother and newborn, which was considered as clinically not significant. There were no reports of awareness or recalls of procedure.

Several studies have been carried out to find out proper non-depolarizing neuromuscular blocking agents that could replace suxamethonium during rapid sequence induction, among these drugs are vecuronium, pancuronium and rapacurium[14,15], but none of these agents accepted clinically, their action was delayed and lasted long, while rocuronium due its rapid onset of action was accepted by Min et al. who concluded that the lower potency is the main reason for rapid onset of action of rocuronium compared with pancuronium or vecuronium [16].

Studies conducted earlier comparing the intubating conditions using rocuronium in a dose of 0.6-1 mg/kg with suxamethonium 1 mg/ kg was questionable as the number of the patients included in the studies were small and there was difference in the onset of action on the laryngeal muscles and the adductor pollicis [11].

The onset of action of many neuromuscular blocking agents has been shorten by using priming (divided dose) technique with improvement of intubating conditions [17,18], but the results with rocuronium is inconsistent , as in Foldes et al. studies there was no benefit of priming, while studies done by Naguib et al. showed more rapid onset of action although there was no improvement in intubating conditions [19,20].

Induction agent used may affect the intubating conditions, positive results found during rapid sequence induction of anesthesia using rocuronium in a dose of 0.6 mg/kg along with propofol which may be a suitable alternative for suxamethonium when the latter is contraindicated [21]. In another study, increasing the dose of thiopentone to 6 mg/kg combined with 0.6 mg/kg of rocuronium resulted in acceptable intubating conditions, although onset of action was 80 seconds, almost similar to what we have observed in our study. Rocuronium does not cross the placenta in significant amounts [22].

Recently, sugammadex used to reverse rocuronium in caesarean sections, even profound rocuronium-induced neuromuscular blockade was reversed rapidly and predictably and no signs of recurarization or adverse effects were noted in the perioperative period [23].

V. CONCLUSION

The results from this study show that rocuronium in a dose of 0.6 mg/kg when used for rapid sequence induction in elective caesarean section provides satisfactory intubating conditions, it has no side effects on the mother or the child. Rocuronium can be an effective and safe alternative for use during elective cesarean section.

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AUTHORS

First Author – Dr. Mohammed Husam Nafie, M.B.Ch.B., D.A Anesthesia, Department of Anesthesia, Rizgary Teaching Hospital and Zheen International Hospital, Kurdistan-Iraq.

Telephone No: 009647504481926, Email:
mhn.nafie@yahoo.com