Evaluation of Intubating Dose of Rocuronium and Propofol-Ketamine Association for Rapid Sequence Induction of General Anaesthesia for Cesarean Section in Extremely Urgent Settings

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Abstract

Purpose: Anaesthetic practice for caesarean section (C&S) has changed during the last decades. Although, general anesthesia (GA) for C&S still seems to be the method of choice in extremely urgent settings, past anesthetic evidence has shown that GA is with increased risk of anesthesia-related maternal and neonatal mortality. Rocuronium bromide (RB) provides the shortest onset of action of nondepolarizing blocking agents. Ketamine has been shown to improve intubating conditions when used in association with RB. Propofol is known to depress laryngeal reflexes. We investigated conditions of tracheal intubation and the Apgar scores of the newborn after administration optimum dose of RB-propofol-ketamine association for rapid sequence induction of anaesthesia in 86 parturients undergoing C&S.

Methods: After preoxygenation, then induced in rapid sequence with propofol 2mg/kg, ketamine 1mg/kg, RB 0.4 or 0.6mg/kg. Retrospectively, the patients were evaluated intubating dose of rocuronium bromide, conditions of tracheal intubation and the Apgar scores.

Results: Tracheal intubation was being easily performed at 30 seconds after the administration of RB in all patients. At the end of the procedure, which lasted 25-40min, the T4/T1 ratio ranged >75%; neuromuscular blockade was not antagonized in 78 patients. Neuromuscular blockade was antagonized with a mixture of atropine 0.02mg/kg and neostigmine 0.05mg/kg in 8 patients who induced 0.6mg/kg RB. Although having C&S for foetal distress undertaken, the Apgar scores at 1 and 5 minutes were >7 and >9 on the 86 neonates in this our survey.

Conclusions: The optimum dose of RB is 0.4mg/kg and propofol-ketamine association can be safely used for rapid sequence induction for C&S.

Keywords: Cesarean section; General anesthesia; Rocuronium Bromide; Propofol; Ketamine; Apgar scores

Introduction

The choice of anaesthetic technique and drug must be appropriate to the clinical situation undergoing cesarean section. If time is the limiting factor, sometimes general anesthesia is necessary because it offer rapid induction, reliability, controllability, reproducibility, and avoidance of sympathectomy-induced hypotension. The morbidity and mortality associated with general anesthesia are in relation, pulmonary aspiration of gastric contents and difficulties with tracheal intubation.

Rocuronium is a monoquaternary, aminosteroidal, nondepolarizing neuromuscular blocking drug with a rapid onset of action [1]. Abouleish et al. [2] have used thiopental-rocuronium for rapid sequence induction of anesthesia in patients undergoing elective cesarean section and have shown that rocuronium does not readily cross the placental barrier, as evidenced by a low umbilical venous/maternal venous plasma concentration of rocuronium.

The conditions of tracheal intubation are affected not only by the type of muscle relaxants used but also by the choice of anesthetic [3-5]. Ketamine can be safely used for the induction of general anesthesia in patients undergoing cesarean section [6,7] In addition propofol is known to depress laryngeal reflexes. Baraka et al. [8] have shown that ketamine-rocuronium is suitable for rapid sequence induction of anesthesia whenever succinylcholine is contraindicated, since tracheal intubation can be easily performed at 50% neuromuscular blockade (NMB), 42±14 seconds after the administration of rocuronium.

We investigated optimum intubating dose of rocuronium bromide, conditions of tracheal intubation and the Apgar scores of the newborn baby after administration propofol-ketamine association for rapid sequence induction of anaesthesia in 86 parturients undergoing cesarean section.

Materials and Methods

This survey was a retrospectively study performed on 86 patients having Caesarean section for foetal distress undertaken in Hospital University of Ufuk in the period of 2009-2010. Our institutional review board did not require written, informed consent because the patient treatment recorded was the one in use clinically. The data were reviewed from the patient’s medical records. ASA physical status I or II, were included in this study. Exclusion criteria were patients with predictably difficult airways or obesity, patients receiving drugs known or suspected to interfere with neuromuscular function, hypertensive and preeclamptic parturients and patients with any renal or hepatic dysfunction.

In the operating room, without premediation patients were monitored with an electrocardiogram (ECG), a noninvasive blood

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Received November 23, 2011; Accepted January 05, 2012; Published January 10, 2012


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pressure monitor, a pulse oximeter and a capnograph. Surface electrodes of TOF GUARD (Acceleromyogram – Organon Teknika – Belgium) were applied to forearm to stimulate ulnar nerve. An intravenous infusion of lactated Ringer’s solution 7ml/kg/h was started on the dorsum of the non dominant hand. The patient was maintained on spontaneous breathing with 100% oxygen by face mask for 3 min and then induced in rapid sequence with propofol 2mg/kg, ketamine 1mg/kg, rocuronium was then injected as a single bolus 5s immediately after loss of consciousness. Intubation was performed 30 s after induction with an excellent clinical intubating score. Intubating conditions were scored as excellent (8-9), good (6-7), fair (3-5) or poor (0-2) according to a system described by Cooper (Table 2). The conditions at laryngoscopy and intubation were assessed for mask ventilation easy, jaw relaxed, vocal cords open, and no coughing. After tracheal intubation and until delivery of the newborn, patients were ventilated using 100% oxygen only. The mean extraction time of fetus was 4 min. After delivery, anesthesia was maintained with an: O₂ mixture (50%:50%) supplemented with remifentanil 1μg/kg/min and propofol 2mg/kg/h. At the end of the procedure, which lasted 25-40 min, the T4/T1 ratio ranged >75%; neuromuscular blockade was not antagonized. But the T4/T1 ratio ranged <75%; neuromuscular blockade was antagonized with a mixture of atropine and neostigmine. No adverse events such as muscle weakness, disagreeable dreams or hallucinations, or patient discomfort were observed or reported by the patient. Apgar scores of the newborns were assessed at 1 and 5 min.

We collected the following information: maternal age, body mass index (BMI), heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), main blood pressure (MAP) and SpO₂, the main onset time (NMB) and the main recovery time and neonatal evaluation included Apgar scores at 1 minute and 5 minute.

Only two doses were used then say patients received either 0.4 or 0.6 mg. Patients were allocated to two groups as doses rocuronium bromide: Group A consisted of 59 patients who had anesthesia induced by rocuronium bromide 0.4 mg/kg. Group B consisted of 27 patients who had anesthesia induced by rocuronium bromide 0.6mg/kg.

The obtained data were analyzed, using Statistical Package for Social Sciences (SPSS software, Version 11.0; Chicago, IL, USA). The demographic data, hemodynamic data, dose of rocuronium, the Apgar scores was evaluated using the mean ± standard deviation, unpaired t-test and Pearson Chi-Square test. P< 0.05 was considered significant.

Results

Demographic data

The patients were within limit in regard to age and body mass index (BMI). The mean age was 31.7 ± 1.9 (yr) in group A and 32.3 ± 2.2 (yr) in group B. The mean BMI was 28.7±4.0 (kg/m²) in group A 29.4 ± 3.2 (kg/m²) in group B. The patients in group A and group B were not significantly different in regard to age and body mass index (see Table 1).

Hemodynamic evaluation

The mean sistolic blood pressure (SBP) was 122.89±13.51 (mmHg) in group A; 119.32 ± 3.12 (mmHg) in group B during operation. The mean diastolic blood pressure (DBP) was 75.00±8.32 (mmHg) in group A; 73.20 ± 7.22 (mmHg) in group B. The mean heart rate (HR) was 84.37±8.9 (bpm) in group A; 80.72 ± 5.6 (bpm) in group B during operation. The mean SpO₂ was 97.7±4.3 in group A; 98.45 ± 7.2 in group B. These values showed in normal limits and stability. The patients in group A and group B were not significantly different in regard to means SBP, DBP, HR and SpO₂ (see Table 1).

Neuromuscular block Conditions

As shown in Figure 1, neuromuscular block evaluation was based the main onset time 30.23±6.53(s) in group A; 28.32±5.34 (s) in group B. The patients in group A and group B were not significantly different in onset time. The main recovery time were 28.34± 8.53(min) in group A; 39.24±7.35 (min) in group B. The mean doses of rocuronium bromide was 29.52±7.96 (mg) in group A; 48.23 ± 9.54 (mg) in group B. The patients in group A and group B were significantly different recovery time and dose of rocuronium bromide.

Intubation Conditions

For rapid sequence induction and tracheal intubation rocuronium bromide 0.4 or 0.6mg/kg after injection of propofol 2mg/kg and

Demographic Data:

<table>
<thead>
<tr>
<th>Score</th>
<th>Jaw relaxation</th>
<th>Vocal cards</th>
<th>Response to intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Impossible to open</td>
<td>Closed (adducted)</td>
<td>Severe coughing or bucking</td>
</tr>
<tr>
<td>1</td>
<td>Opens with difficulty</td>
<td>Closing</td>
<td>Mild coughing</td>
</tr>
<tr>
<td>2</td>
<td>Moderate opening</td>
<td>Moving movement</td>
<td>Slight diaphragmatic</td>
</tr>
<tr>
<td>3</td>
<td>Easy opening</td>
<td>Open (relaxed)</td>
<td>No movement</td>
</tr>
</tbody>
</table>

Table 1: The maternal and neonatal evaluation.

| Table 2: Cooper scoring system.

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Figure 1: The doses (1), onset time (2) and duration (3) neuromuscular blockade of rocuronium bromide.
neonatal depression unless used in doses above 1-1.5mg/kg. We have even if ketamine crosses the placenta rapidly, it does not produce intubating conditions when used in association with rocuronium [8].

Ketamine has been shown to improve blocking agents [11,12]. Ketamine has been shown to improve related maternal and neonatal mortality [9].

Rocuronium provides the shortest onset of action of nondepolarizing of choice in extremely urgent settings, past anesthetic evidence has last decades. Although, general anesthesia still seems to be the method

Discussion

Anaesthetic practice for caesarean section has changed during the last decades. Although, general anesthesia still seems to be the method of choice in extremely urgent settings, past anesthetic evidence has shown that general anesthesia is with increased risk of anesthesia-related maternal and neonatal mortality [9].

Obstetric patients undergoing caesarean section under general anaesthesia require rapid induction due to high risk of aspiration [10]. Rocuronium provides the shortest onset of action of nondepolarizing blocking agents [11,12]. Ketamine has been shown to improve intubating conditions when used in association with rocuronium [8]. Even if ketamine crosses the placenta rapidly, it does not produce neonatal depression unless used in doses above 1-1.5mg/kg. We have used in doses 1mg/kg and none of the neonates in the series had the need for ventilatory assistance neurologic outcome.

The success of the anaesthesia methods was determined by assessing the Apgar scores of the newborn baby. Maternal outcome studies have primarily focused on maternal mortality, and neonatal outcome studies have focused on umbilical cord pH, Apgar score, the need for ventilatory assistance at birth and neurobehavioral score [11]. The baby can be affected directly by transplacental drug transfer or indirectly by alteration of foetal-placental perfusion, or both. The risks of direct effects from placenta transfer are greatest with general anaesthesia, because maternal drug exposure is greater for caesarean delivery. In our this survey, although having Caesarean section for foetal distress undertaken, the Apgar scores at 1 minute and 5 minute were >7 and >9 on the 86 neonates in this our survey.

Using ketamine for induction of general anesthesia in parturients who were undergoing cesarean section not only facilitates tracheal intubation at 50% NMB but, may allow the administration of 100% oxygen without anesthetic supplementation until delivery of the newborn. However, because of the sympathomimetic effects of ketamine, it is contraindicated in hypertensive and preeclamptic parturients. Also, recovery after ketamine may be associated with disagreeable dreams or hallucinations [13]. We have used in doses 1-1.5mg x kg and disagreeable dreams or hallucination were not observed or reported by the patient.

Abouleish et al. [2] have used thiopental-rocuronium for rapid sequence induction of anaesthesia in patients undergoing elective cesarean section and have shown that rocuronium does not readily cross the placental barrier, as evidenced by a low umbilical venous/maternal venous plasma concentration of rocuronium. However, because of inadequate neuromuscular block, as well as patient movement during tracheal intubation, they had to increase the dose of thiopental from 4 to 6mg/kg and to delay the time of intubation from 60 to 80-90 seconds. The conditions of tracheal intubation are affected not only by the type of muscle relaxants used but also by the choice of anesthetic [4,13].

Propofol is known to depress laryngeal reflexes [14,15]. Propofol is an alternative to thiopental for induction of general anaesthesia for cesarean section. It crosses the placenta and induces vasodilatation of isolated vessels and may therefore alter fetal placental vascular resistance. Soares de Moura et al. have studied that the direct effect of propofol on the fetal placental circulation in vitro [16]. They have evaluated that the actions of propofol on vasoconstrictive effects induced by angiotensinII, bradykinin, prostaglandin F and potassium chloride. Propofol induced vasodilatation and inhibited the vasoconstrictive effects of bradykinin and prostaglandin F, in the human placenta. These findings suggest that propofol may not reduce fetal placental blood flow. Since propofol reduced the vasoconstricting effect of potassium chloride but not that of angiotensinII, they have proposed that the vasodilatory effect of propofol in the human placenta involves inhibition of Ca2+ channels.

Rocuronium had no untoward effects on the neonates, evaluated by 1 and 5 min Apgar scores. At delivery in 32 patients, concentration of rocuronium in maternal venous (MV) and umbilical venous (UV) plasma were 23(2)180ng/ml and 3895(27.8)ng/ml, respectively (UV/ MV ratio 0.16. In 12 patients, the mean concentration of rocuronium in umbilical arterial (UA) plasma was 271 Abouleish et al. [2] have shown that II (34.7)ng/ml with a UA/UVRatio of 0.62. 17-Desacylrocuronium (Org 9943), the main metabolite of rocuronium was below the sensitivity level (25ng/ml) in umbilical venous and arterial plasma; the maternal venous plasma concentration was 178 (31)ng/ml.

Figure 2: The mean Apgar scores at 1st minute (1) and 5th minute (2).
We concluded that the combination of the induction agents propofol 2 mg/kg, ketamine 1mg/kg and 0.4mg/kg rocuronium bromide have guaranteed the success of obstetric anaesthesia in this clinical context.

References


