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Research Article

Tracheal intubation for cesarean section without muscle relaxant: An alternative for rapid tracheal intubation with no adverse neonatal effect

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KEYWORDS

Cesarean section;
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Abstract *Background:* Difficult tracheal intubation following induction of general anaesthesia for caesarean section is a cause of morbidity and mortality. Till today, succinyl choline is the relaxant of first choice for endo-tracheal intubation However, its use is associated with marked muscle fasciculations and intense muscle pains on the day after the operation especially in young patients. Tracheal intubation may be accomplished without a muscle relaxant. In this study, we evaluated in double-blinded, prospective, randomized intubation conditions for cesarean section with fentanyl without muscle relaxant administration to obtain clinically acceptable intubation conditions and cardiovascular responses.

Methods: After the gaining of ethical approval, 100 parturients scheduled for elective cesarean delivery were randomly allocated to receive both fentanyl 2 μg/kg and propofol 2 mg/kg in group

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F, propofol 2 mg/kg and succinyl choline 1 mg/kg in group S. Tracheal intubation was graded by the anesthesiologist performing the intubation who was blinded to induction agents.

Results: Overall intubating conditions were regarded as acceptable in 90%, and 94% of patients in groups F and S, respectively. Apgar score and blood gases of babies were not different between two groups.

Conclusion: The results suggested that healthy pre-medicated women with favorable airway anatomy who are scheduled for cesarean section can be reliably trachealy intubated 90 s after co-administration of fentanyl 2 μg/kg and propofol 2 mg/kg with satisfactory fetal outcome.

1. Introduction

Failed endo-tracheal intubation (incidence 1:300 for obstetric patients versus 1:200 for all patients) during general anesthesia is a one of the major causes of maternal morbidity and mortality. Every effort should be made to ensure optimal conditions prior to the start of anesthesia and to follow measures aimed at preventing these complications [1].

Induction of anesthesia is commonly facilitated by the administration of a combination of short-acting hypnotic drugs, opioids, and depolarizing or non-depolarizing muscle relaxants. The use of succinyl choline is controversial because of its complications. The most frequently reported side effects were bradycardias, fasciculations, myalgias, allergy and hyperkalemia. Asystole was also reported [2].

Even the use of non-depolarizing relaxants may also have undesirable effects such as prolonged blockade and the need to reverse it which may be a problem if difficult intubation is suspected. So, it may be preferable in some instances to perform endo-tracheal intubation without neuromuscular blockade [3].

Successful tracheal intubation during propofol–fentanyl anesthesia without muscle relaxants has often been reported [4].

Propofol is an ideal induction agent as it produces reliable sedation, good operating conditions, haemodynamic stability, profound amnesia and decrease post-intubation hypertension [5].

The administration of fentanyl with propofol decreases the hypertensive response to intubation and reduces the blood concentration of propofol required to achieve adequate anesthesia for tracheal intubation [6].

The goal of this study was to evaluate intubating conditions, haemodynamic responses and fetal outcome in two groups of parturients scheduled for cesarean section after induction of anesthesia with propofol–fentanyl versus propofol–succinyl choline.

2. Patients and methods

After obtaining approval from the ethical and scientific committee of our hospital and written informed consent, we studied 100 ASA I and II parturients scheduled for elective cesarean section. Patients whose physical characteristics suggested difficulties in intubation (Modified Mallampati score III or IV and those who had a previously documented failed intubation were excluded. Patients with history of reactive airway disease including asthma and history of upper gastro-intestinal tract reflux were also excluded.

All patients were pre-hydrated with saline 0.9% 5 ml/kg before induction; they were also pre-medicated with oral ranitidine 150 mg 1 h before anesthesia.

Parturients were randomly enrolled using a computer-generated randomization code into two equal groups according to the used induction drugs into one of the following groups: group F – to receive fentanyl 2 μg/kg plus propofol 2 mg/kg, and group S – to receive propofol 2 mg/kg plus succinyl choline 1 mg/kg. Fentanyl and succinyl choline solutions are looking identical.

After a 2 min period of breathing oxygen, anesthesia was induced by an assistant behind a drape so that the anesthesiologist performing the intubation was blinded to drug doses. In group F fentanyl 2 μg/kg was given, and then propofol 2 mg/kg was injected over 30 s.

Once the parturient became unconscious, ventilation was maintained via a face mask. Ninety seconds after completion of drug administration, laryngoscopy and intubation was attempted using a Macintosh 3 laryngoscope blade and a 7.0 mm endo-tracheal tube.

The quality of intubation was graded by anesthesiologist blinded to induction agents using the following scoring system: (a) excellent defined by flaccid relaxation of jaw muscles, mouth open widely, good cord visualization, well separated, abducted cord, and no bucking at intubation; (b) satisfactory defined by mouth easily opened, well relaxed jaw muscles, good cord visualization, slight cord movement when touched but abducted, and no bucking on intubation; (c) fair defined by conditions less favorable, jaw muscles not well relaxed, cord visualization fair but allowing intubation, and bucking on intubation; (d) unsatisfactory defined by resistance to mouth opening, poor relaxation of jaw muscles, poor cord visualization or none, cord abducted if viewed, superior pharyngeal constrictor muscle activity and intubation cannot be done or marked bucking and body movement on intubation [7].

Patients who could not be intubated on the first attempt in group F were given succinyl choline 1 mg/kg, and intubation was completed. Once the trachea was intubated and the cuff was inflated slowly.

Measurements of heart rate, mean arterial pressure and arterial O_2 saturation were noted at different time intervals (pre-induction, post-induction, post-intubation at 0, 1, 3 and 5 min).

Balanced anesthesia was maintained with O_2 and sevoflurane (2%).

The neonates were dealt with by a pediatrician blinded to the group assignment. Apgar scoring was assessed at 1 and 5 min of delivery (Table 2). Umbilical artery pH and P_{CO_2}, were measured at delivery. Additionally, the need for ventilatory assistance and intensive care unit admission was recorded.

2.1. Statistical analysis

Based on a pilot study, a sample size of 40 was required for an 80% chance of demonstrating a significant difference ($p < 0.05$) between groups. According to statistician, 45 patients were selected for each group, where any results could be statistically significant. N.B.: Extra numbers were taken to avoid defaulters. The statistical analysis of data done by using excel program and SPSS program statistical package for social science version 14. To test the normality of data distribution K-S (Kolmogorov–Smirnov) test was done. Only significant data revealed to be non-parametric. The description of the data done in the form of mean ± SD for quantitative data. The analysis of the data was done to test statistical significant difference between groups. ONE WAY ANOVA test is followed by Post Hoc test LSD (least significant difference) for intra-group comparisons. For quantitative date Student's *t*-test was used to compare between two groups. Chi-square test was used for qualitative data.

N.B.: *p* is significant if < or = 0.05 at confidence interval 95%.

3. Results

There was no significant difference in demographic data between the two groups (Table 1). Excellent intubating conditions were achieved in 29 (58%) out of 50 patients in group F and 46 (92%) out of 50 patients in group S. Sixteen patients in group F (32%) and two patients in group S (4%) showed satisfactory intubating conditions. Fair intubating conditions were observed in 3 (6%) patients in group F as compared to 2 (4%) in group S. Unsatisfactory intubating conditions were observed in 2 (4%) patient in group F and no patient in group S (Fig. 2). For both these patients, additional bolus dose of 1 mg/kg propofol was administered, and a second attempt of intubation was made. Since this could not facilitate intubation, succinyl choline 1 mg/kg was administered and intubation was completed.

3.1. Overall intubating conditions

Acceptable intubating conditions (excellent and satisfactory) were observed in 45 patients in group F (90%) and in 48 patients in group S (94%) (not statistically significant). Unacceptable intubating conditions (fair and unsatisfactory) were observed in 5 patients in group F (10%) and 2 patients in group S (4%); this was not statistically significant (Fig. 2).

3.2. Haemodynamic changes during intubation

There was significant decrease in heart rate in group F after induction, at 0 (intubation), 1, 3 and 5 min when compared to basal values, whereas group S showed significant increase in heart rate after induction, at 0 (intubation), 1, 3 and 5 min when compared to group F (Table 2).

There was significant decrease in mean blood pressure both groups after induction, at 0 (intubation), 1, 3 and 5 min when compared to basal values, whereas group S showed significant increase in mean blood pressure after induction, at 0 (intubation), 1, 3 and 5 min when compared to group F (Fig. 1).

There was no significant change in neonatal umbilical arterial blood gases and Apgar score between three groups during the study period (Table 3). No case was admitted to ICU. Two babies, one belongs to group F and the other to group S need ventilator support in the form of CPAP because of ITTA.

4. Discussion

Anticipation of difficult endo-tracheal intubation during cesarean section make the technique of tracheal intubation without the use of muscle relaxant advantageous in such cases as it allows assessment of the airway by laryngoscopy and possibility of oxygenation which may be life saving for both the mother and baby.

The study showed that healthy pre-medicated women with favorable airway anatomy who are scheduled for cesarean section can be reliably trachealy intubated 90 s after co-administration of fentanyl 2 μg/kg and propofol 2 mg/kg. This may be attributed to that propofol is superior to barbiturates in decreasing muscle tone and abolishing laryngeal responses to tracheal intubation or to laryngeal mask insertion [8,9]. Increasing the depth of anesthesia by administration of fentanyl suppress the haemodynamic response to endo-tracheal intubation; as it's proved that addition of opioids in general improve intubating condition [10–13].

Keaveney and Knell [14] reported adequate intubating conditions by the use of propofol 2.5 mg/kg. Saarnivaara and Klemola [15] reported successful intubation in 86% of patients using alfentanil 30 μg/kg and propofol 2.5 mg/kg. Similarly, Coghlan et al. [16] achieved similar success rate using alfentanil 20 μg/kg and propofol 2.5 mg/kg.

Scheller et al. [3] reported that the trachea could be reliably intubated without neuromuscular blockade in most healthy, premeditated patients who received at least 40 pg/kg alfentanil prior to propofol 2.0 mg/kg.

Andel et al. [17] studied the required dose of propofol used in combination with fentanyl for successful tracheal intubation without neuromuscular blocker. They reported that a dose of 2.7 mg/kg is needed. Ko et al. [18] reported that administration

Table 1 Patients characteristics: maternal age, maternal weight, height and gestational age. Values are in mean ± SD.

	Group F	Group S
Age (years)	27.7 ± 3.4	26 ± 4.1
Weight (kg)	76.5 ± 6.4	77.6 ± 64
Height (cm)	161.6 ± 2.3	163.3 ± 3.5
Gestational age (weeks)	38.7 ± 0.9	38.8 ± 0.7

p value <0.05 is significant.

Table 2 Heart rate changes (bpm) of the studied groups. Values are in mean ± SD.

	Group F	Group
Before induction	99.3 ± 5.0	102.9 ± 17.4
After induction	92.2 ± 11.2[+]	99.8 ± 13.3[*]
0 min (intubation)	91.1 ± 11.2[+]	99.4 ± 18.5[*]
1 min	88.2 ± 12.7[+]	98.5 ± 20.0[*]
3 min	89.5 ± 8.0[+]	98.2 ± 12.7[*]
5 min	89.9 ± 10.3[+]	99.5 ± 20.0[*]

[+] Significant difference when compared to basal value ($p < 0.05$).
[*] Significant difference when compared to F group.

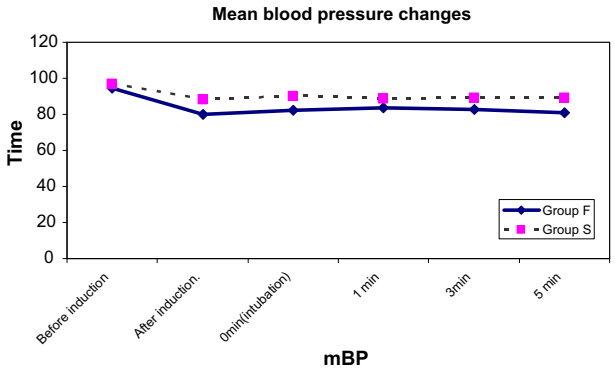

Figure 1 Mean arterial blood pressure (mmHg) of the studied groups.

Table 3 Neonatal outcomes (neonatal umbilical arterial blood gases and Apgar score). Data are presented as mean ± SD, Apgar score is present as median (range). P_{O_2} is partial pressure of oxygen; P_{CO_2} is partial pressure of carbon dioxide.

	Group F	Group S
pH	7.29 ± 0.07	7.31 ± 0.08
P_{CO_2}, mmHg	53.2 ± 10.5	56.1 ± 7.8
P_{O_2}, mmHg	19.5 ± 18.7	17.0 ± 19.5
Base deficit (mmol/l)	1.68 ± 0.3	1.8 ± 0.7
Apgar 1 min	9 (8–10)	7 (5–8)
Apgar 5 min	10 (9–10)	9 (9–10)

of a bolus dose of fentanyl 5 min before intubation was more effective to blunt haemodynamic stress response for laryngoscopy and tracheal intubation.

In light of the above studies, anaesthesia for cesarean section was induced by co-adminstration of propofol 2 mg/kg and fentanyl 2 μg/kg.

Our results showed that acceptable intubating conditions (excellent and satisfactory) were observed in 90% of patients in group F and 94% in group S.

Unacceptable intubating conditions (fair and unsatisfactory) were observed in 10% of patients in group F, and 4% in group S (Fig. 2).

Almos et al. [19] reported that propofol only without neuromuscular blocker is insufficient regimen for intubation as the laryngotracheal reflexes are not suppressed, as well propofol does not prevent haemodynamic responses. Premedication with fentanyl provides better intubating conditions.

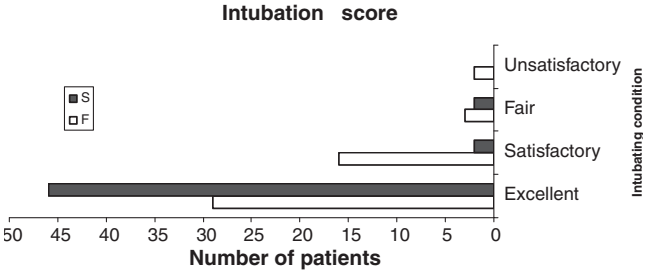

Figure 2 Scoring conditions for tracheal intubation.

Similarly, Gupta et al. [20], and de Fatima de Assuncao Braga et al. [21] also concluded that propofol–fentanyl is a good combination for tracheal intubation without a significant haemodynamic changes.

The pattern of haemodynamic response to induction of anesthesia was consistent with other studies; Safiya and Vijayalaxmi [22] reported that heart rate decreased significantly after intubation in patients who received fentanyl and propofol, whereas heart rate was increased in patients given propofol–suxamethonium. The same authors demonstrated a highly significant drop in systolic blood pressure from pre-induction value in propofol–fentanyl group, whereas it increased in suxamethonium group. Kanaya et al. [23] explained that induction of anesthesia with propofol caused larger decrease in muscle sympathetic nerve activity and blood pressure, indicating a decrease in peripheral sympathetic nerve activity with an insignificant increase in heart rate, indicating a decrease in cardiac parasympathetic nerve activity in humans.

In the present study, there was significant decrease in heart rate in group F after induction when compared to basal values, whereas group S showed significant increase in heart rate after induction when compared to group F. There was significant decrease in mean blood pressure in all groups after induction when compared to basal values, whereas group S showed significant increase in mean blood pressure after induction when compared to group F.

This result are comparable with the finding of Dahlgren and Messeter [24] who reported that low dose fentanyl before intubation effectively blunt the haemodynamic response to intubation.

Our results regarding the neonatal blood gases and Apgar score do not match with the concept of adverse neonatal effect following the use of analgesics; there was no significant change in neonatal umbilical arterial blood gases and Apgar score between three groups during the study period and this was consistent with the results of Frolich et al. [25] who reported that maternal analgesia and sedation with fentanyl (1 μg/kg) and midazolam (0.02 mg/kg) immediately prior to spinal anesthesia is not associated with adverse neonatal effect.

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