



ORIGINAL RESEARCH PAPER

Anaesthesiology

A COMPARISON OF HAEMODYNAMIC RESPONSES BETWEEN CLINICAL ASSESSMENT-GUIDED NASOTRACHEAL INTUBATION AND NEUROMUSCULAR BLOCK MONITORING-GUIDED NASOTRACHEAL INTUBATION : A PROSPECTIVE, RANDOMISED STUDY

KEY WORDS: Haemodynamic, neuromuscular monitor, tracheal intubation,

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ABSTRACT

Aim: The aim of study was to compare the effects of nasotracheal intubation on cardiovascular responses when the appropriate moment for intubation was directed by either clinical judgment or train-of-four assessment.

Method: 60 normotensive, ASA grade I & II patients, aged 18 to 60 years, scheduled for elective maxillofacial surgery under general anaesthesia selected. In Group M patients, intubation was done after train of four counts became zero in adductor pollicis muscle, in Group C the intubation was done after the clinical judgment of jaw muscle relaxation. Changes in heart rate (HR) and mean arterial pressure, intubating conditions and the time between the administration of a neuromuscular blocking agent and intubation were recorded.

RESULT The two groups were comparable in demographic parameters. HR and mean arterial pressure were significantly higher in Group C as compared to Group M after intubation ($P < 0.05$). The mean time required for intubation was significantly shorter in Group C compared to Group M (193 ± 7 s vs. 403 ± 101 s). Excellent and good intubation conditions were observed in all Group M patients, But in 22 out of 30 patients (73%) of Group C.

CONCLUSION: Haemodynamic responses to nasotracheal intubation can be significantly attenuated if nasotracheal intubation is based on neuromuscular monitoring of adductor pollicis muscle.

INTRODUCTION

Nasotracheal intubation is commonly performed in patients undergoing oral, dental and maxillofacial surgeries. It is associated with sympathetic stimuli that leads to hypertension, tachycardia and arrhythmia. The stimulation of nose and nasopharynx, which does not occur during orotracheal intubation, is responsible for the greater sympathetic response to nasal intubation. This response depends on type and depth of anaesthesia, age of patient, duration of intubation, the increased stretching of the tissues as well as ease of the procedure^[1]. To blunt this sympathetic response, many drugs are successfully used. Administration of an additional drug might cause adverse effects or effects of drug may persist even after end of the sympathetic response. Hence, a non-pharmacological measure to reduce the response is preferred. Achievement of adequate neuromuscular block with neuromuscular blocking drugs and the choice of an appropriate moment for intubation play an important role in sympathetic response^[2]. In clinical practice, many anesthesiologists commence laryngoscopy based on the clinical assessment^[3]. Neuromuscular monitoring is good guidance whenever there is a need to use neuromuscular blockade to significantly improve the quality of intubation and reduce airway injury. Literature is very limited regarding comparison of neuromuscular monitoring over clinical assessment of adequate muscle relaxation for the purpose of haemodynamic fluctuations after nasal intubation. We aimed at evaluation of neuromuscular block monitoring in preventing haemodynamic fluctuations following nasal intubation after administration of vecuronium. We hypothesized that neuromuscular block monitoring-guided intubation would elicit lesser sympathetic response compared to clinical assessment-guided intubation.

METHODS

This prospective, randomised trial was conducted after approval from institutional ethical committee. Patients of either sex, 18–60 years of age and belonging to the ASA grade I & II, posted for elective dental, maxillofacial surgery were included in the study. Patient's refusal, anticipated difficult airway, patients with hepatic, renal, cardiovascular, Coagulation disorder, nasal obstruction, Suspected basilar skull fractures, Recent nasal-oral surgery were excluded from the study. After pre-anaesthetic check-up, informed consent was obtained. All patients were kept fasted for 8 hour and were pre-medicated with tab Alprazolam 0.25 mg, tab Ranitidine 150 mg before sleep and at 6 am on the day of surgery. Fifteen minutes before shifting the patient to the OT table, 0.1% Xylometazoline nasal drops were instilled in both the nostrils^[4].

electrocardiogram, automated non-invasive blood pressure, pulse oximeter, neuromuscular monitor (train of four [TOF] watch) and bispectral (BIS) index monitor were attached, baseline vitals were recorded. Peripheral venous access was secured. 2% lignocaine hydrochloride gel applied in both nostrils, most patent nostril was selected. All patients were premedicated with inj. Glycopyrrolate 0.004 mg/kg, inj fentanyl 1.5 µg/kg, patients were ventilated for 3 min with 100 % oxygen, Induction was done with propofol 2 mg/kg till the disappearance of the eyelash reflex. After induction, a supramaximal TOF stimulus was applied to the ulnar nerve at the wrist through surface electrodes (stimulation current set at 60 mA) using acceleromyograph after automatic calibration. Baseline TOF ratio percentage was noted. Then intravenous vecuronium 0.1 mg/kg was administered over 5s, and lungs were ventilated with sevoflurane in 100% oxygen maintaining a BIS score of 40–60 till the nasal intubation.

In the study, dosing of muscle relaxant, selection of study population, use of neuromuscular block monitor etc were as per the Stockholm revision of good clinical research practices, 2007^[4]. The technique of nasal intubation was as per randomized group. Totally, 60 patients were randomized into two groups (Group C and Group M) using a computer-generated block randomization.

Assessment for nasal intubation started after 1 min of vecuronium administration and done every 30 sec by an experienced anesthesiologist. In Group C, intubation was based on clinical assessment like ease of ventilation, jaw and upper airway tone. Jaw tone was assessed by attempting to open patients mouth whereas upper airway tone was determined by amount of jaw support necessary to maintain patent airway. In Group M, intubation done after complete loss of all 4 responses to TOF stimulation (TOF count zero). The electrical stimulation was done with 60 mA, 2 Hz current lasting 0.2 ms.

Nasal Intubation was done with appropriate sized, well lubricated with 2 % lignocaine gel, cuffed ET tubes. Nasotracheal tube was inserted through the most patient's nostril until its tip lies in the pharynx. Then laryngoscopy was performed and a view of laryngeal opening was obtained. Different manoeuvres like use of external laryngeal pressure and Magill forceps were used to improve glottis exposure in case of difficult intubation. If all attempts failed, oral intubation was performed, and that candidate was excluded from the study. Anaesthesia was maintained using Sevoflurane in O₂: N₂O (40:60) mixture and maintaining a BIS of 40–60 and EtCO₂, 36 - 40 mm Hg throughout the procedure.

In the operating room, monitors including 5-lead

The primary outcome was HR changes in response to nasal intubation. HR was recorded at different time intervals. The secondary objectives included changes in mean arterial pressure in response to intubation and intubating conditions was graded using the Krieg's intubating score, ranging from 3 (best possible intubating conditions) to 12 (worst possible conditions). The laryngoscopic views were graded as per Cormack-Lehane (CL) grading. The time between the administration of a neuromuscular blocking agent (end of 5s infusion) and nasal intubation (end of 5s inflation of the sealing cuff) was also recorded.

HR and mean arterial pressure are presented as mean ± standard deviation (SD). Between group comparisons of the means of HR and mean arterial pressure are done by ANOVA test. For categorical data, Chi-square test was used as a test of significance. P ≤ 0.05 was considered as significant. Statistical analysis is done using software SPSS 16 (IBM, Armonk, NY, USA). Complications like epistaxis, failed nasal intubation, laryngospasm during intubation, and sorethroat, hoarsness of voice after extubation were also noted.

RESULTS

A total 60 patients were recruited and all patients were included for analysis, and there were no exclusions after recruitment as none of the patients had failed nasal intubation or required more than one attempt for intubation. The demographic profile with respect to age, sex, height, weight and BMI was comparable in the two groups.

The mean HR and mean arterial pressure were higher in Group C than Group M with statistical significance (P < 0.05) at the T3, T4, T5, T6 points of time, [Figure 1] and [Figure 2]. At T0, T1, T2 time points (i.e., in pre-intubation period), the mean HR and mean arterial pressure were comparable among two groups (P > 0.05). Intragroup analysis shows both in Group C and M, following intubation there was slight decrease in HR just after intubation, after that there was statistically significant rise of HR and mean arterial pressure. Extent of rise of HR and mean arterial were significantly lower in neuromuscular monitoring group than the control group.

Figure 1 – Mean heart rate in two groups (T0 –baseline data; T1 – after induction , T2 – after vecuronium administration; T3 – After intubation; T4 – 2 min after intubation; T5 – 5min after intubation; T6 – 10min after intubation. Error bars are showing standard deviation.

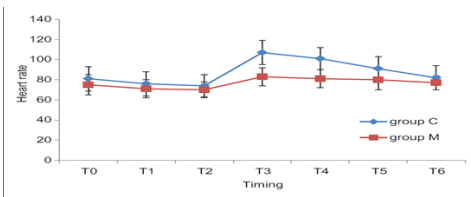
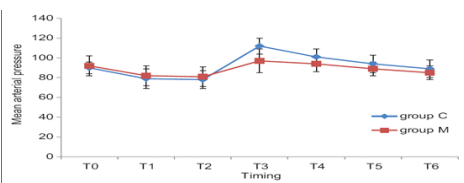


Figure -2 Mean Arterial Blood pressure (T0 –baseline data; T1 – after induction , T2 – after vecuronium administration; T3 – After intubation; T4 – 2 min after intubation; T5 – 5min after intubation; T6 – 10min after intubation. Error bars are showing standard deviations of the data



The mean time from administration of neuromuscular blocking agent and nasal intubation was significantly higher in Group M as compared to Group C (P < 0.0001). BIS values were comparable among two groups (P > 0.05) at different points of time. The CL grading was more favorable in Group M as compared to Group C (P = 0.001) . The intubating score was better in Group M as compared to Group C (P = 0.002)

Table 1 – Study parameters in the two groups

Parameters	Group C	Group M	P value
Mean time from administration of neuromuscular blocking agent and intubation(s)	193 ± 7	403 ± 101	<0.001
CL grading (1:2:3:4) number	22:8:0:0	28:2:0:0	0.001
Intubating condition score (3:4:5) number	19:3:8	28:2:0	0.002

DISCUSSION

We observed from the study that the neuromuscular monitoring-based timing for nasal intubation causes lesser haemodynamic surge as compared to clinical-based timing for nasal intubation. the intubating condition and laryngeal view was better in the neuromuscular monitoring guided group, as compared to conventional clinical assessment-based timing intubation^[14].

The nasal intubation can result in significant haemodynamic response such as tachycardia, hypertension and dysrhythmias. Various pharmacological agents are reported to attenuate these cardiovascular responses.^{[5],[6]} The effect of these drugs may persist for longer time, along with adverse effects. So a non-pharmacological measure to prevent this surge should be preferred. Many studies have already shown that this response also depends on the duration of laryngoscopy and intubation, ease of the procedure. Therefore, achievement of adequate neuromuscular blockade with a muscle relaxant is of utmost importance to avoid undue stimulation of sympathoadrenergic system. Assessment of complete paralysis was done by observing the response to TOF stimulation. When the TOF count becomes zero it can be said that the laryngeal muscles are completely paralysed. In this study, in the neuromuscular monitoring group (M), intubation was performed when the TOF watch showed "zero count" following TOF electrical stimulation^[7].

In our study, patients intubated by clinical judgment showed higher mean values of mean arterial pressure and HR during and after intubation in comparison to the patients who were intubated under guidance of neuromuscular monitoring (P < 0.05). It seems that in patients with incomplete neuromuscular block, nasal intubation cause stronger nociceptive stimulation, hence a stronger reflex cardiovascular reaction.

The previous studies showed that if neuromuscular block monitoring is used for timing of intubation, more time gap would be available between neuromuscular blockade administration and endotracheal intubation. It also improves intubation conditions and minimizes cardiovascular responses.^[9] In a study, the two techniques of tracheal intubation using clinical assessment and neuromuscular monitor-based timing with cisatracurium was assessed.^[7]

They concluded that neuromuscular block monitoring prolongs the endotracheal intubation time, improves intubation conditions and minimizes cardiovascular reactions in comparison to clinical assessment. In that study, the mean time for intubation was 162.3 ± 35 s (mean ± SD) in patients under clinical monitoring group and 339.3 ± 73.7 s (mean ± SD) in patients under neuromuscular monitoring group.

In our study, the values of BIS index in both groups of patients were comparable. Hence, the impact of awareness or sedation status on the intergroup haemodynamic differences appears to be comparable. Adductor pollicis muscle was chosen to monitor the neuromuscular block in our study. It is reported that in the orbicularis oculi muscle, TOF count becomes zero more faster than the adductor pollicis muscle after administration of neuromuscular blocking drugs.^[9] As a result, early intubation can be performed if orbicularis oculi muscle was chosen for monitoring^[8]. However, in some patients, unsatisfactory intubation conditions were found. It has also been reported that when adductor pollicis monitored for tracheal intubation, more favourable intubation condition is observed in all patients.^{[3],[10],[11]}

In the monitoring group, anesthesiologist found intubation score

3 or 4 (excellent or good intubation conditions) in all the 30 patients. However, in the control group, only 22 patients (73%) among 30 patients had good or excellent intubation condition. Literature reports, 95% to 100% of patients were provided with excellent intubation conditions using the same assessment of the reaction to supramaximal TOF stimulation of the ulnar nerve.^{[10],[12]}

Nasotracheal intubation remains a popular technique during microlaryngeal surgery^[13]. Using neuromuscular monitor during nasal intubation is not a common practice. It is mainly used for muscle relaxation monitoring during operative procedure and to diagnose any residual paralysis at the time of extubation. Hence, more research in neuromuscular monitoring during intubation is required. A limitation of the study is that the time gap between fentanyl administration and intubation is different in two groups. This may have contributed to the difference in haemodynamic response in the above-mentioned groups.

CONCLUSION

The haemodynamic responses to nasotracheal intubation can be significantly attenuated if nasal intubation is done following complete paralysis of laryngeal muscles, detected by neuromuscular block monitoring of adductor pollicis muscle as compared to conventional time-based clinical assessment. Furthermore, intubating conditions are improved when nasotracheal intubations were attempted following neuromuscular monitoring.

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