Original Research Paper

Volume - 13 | Issue - 03 | March - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anesthesiology

ATTENUATION OF HAEMODYNAMIC RESPONSE AND OPTIMISATION OF CONDITIONS FOR LARYNGOSCOPY AND TRACHEAL INTUBATION WITH NEUROMUSCULAR MONITORING.

Dr. Dhwani A. Chaudhari — Third year resident doctor, SMIMER Hospital, Surat Department of Anaesthesiology, Surat Municipal Institute Of Medical Education and Research, Surat.

Dr. Sonali A. Joshi — Associate Professor, SMIMER Hospital, Surat Department of Anaesthesiology, Surat Municipal Institute Of Medical Education and Research, Surat.

ABSTRACT **Background and Aims:** Laryngoscopy and endotracheal intubation have well-documented hemodynamic reactions and risks. This study was conducted to compare cardiovascular responses elicited by laryngoscopy and intubation, when the right moment for intubation was assesed either by train-of-four evaluation or clinical judgement. **Methods:** Total of 34 patients who had been scheduled for surgeries under general anaesthesia were randomly assigned to two groups. The intubation in Group A patients was done following the clinical assessment of jaw muscle relaxation and in Group B after the adductor pollicis muscle's train of four counts had decreased to zero. The interval between the administration of a neuromuscular blocking drug and endotracheal intubation, as well as changes in heart rate (HR) and mean arterial pressure, were noted. Chi-square and analysis of variance tests were used to analyse the results. **Results:** Following laryngoscopy and tracheal intubation, Group A had substantially higher heart rate and mean arterial pressure than Group B ($P<0.05$). Group A had a considerably lower mean intubation time compared to Group B (177±8 s vs. 365±101 s). All of the patients in Group B had excellent and good intubation conditions, compared to 12 of the 17 patients (70%) in Group A who had such conditions. **Conclusion:** Neuromusculer monitoring (train of four assessment) guided laryngoscopy and intubation provides better intubating condition and at the same time attenuates the Hemodynamic reactions to same.

KEYWORDS : Haemodynamic reactions, intubating conditions, neuromuscular monitoring, tracheal intubation, vecuronium

INTRODUCTION

Strong nociceptive stimuli are produced during laryngoscopy and endotracheal intubation during the induction of general anaesthesia, leads to unintentional stimulation of the sympathetic nervous system which causes exaggerated haemodynamic response. [1] This may cause myocardial ischaemia or secondary brain injury in patients who have coronary artery disease, arterial hypertension, or intracranial pathology.

The circulatory system's reactions depends upon the type and level of general anaesthesia, patient age, co-occurring cardiovascular disease, or any other systemic disorders, and the medications taken.[2] This reaction is also influenced by the length of the process, including the laryngoscopy and intubation.[3,4] Numerous medications are successfully used to reduce this pressure response.[2] The administration of an extra medication could have a negative impact on hemodynamics or unnecessarily heighten the level of anaesthesia. Therefore, a non-pharmacological approach is preferred to lessen the response.

In order to decrease sympathetic response, it is crucial to obtain an appropriate neuromuscular block with neuromuscular blocking agents. The evaluation of total neuromuscular blockade is required for the determination of correct time of intubation. Visual assessment of the reaction of the thumb adductor to Train of four stimulation of the ulnar nerve at the wrist is commonely used. However, in practical practise, accurate timing and neuromuscular monitoring are rarely used, and many anesthesiologists start laryngoscopy based on clinical assessment after a certain amount of time based on the neuromuscular blocking agent's onset of action.[5]

Our goal was to test the effectiveness of neuromuscular block monitoring in minimising haemodynamic variations and intubating condition following laryngoscopy and intubation after administration of vecuronium.

METHODS

This prospective, randomised trial was carried out in a tertiary care hospital. The study comprised patients who had been scheduled for elective surgeries under general anaesthesia and were of either sex, between the ages of 18 and 60, and ASA grading I or II with modified malampatti class I and II. Patients who refused to participate in the trial, and who were predicted to have difficult airways, had hepatic, renal, cardiovascular, neurological, muscular, or other systemic disorders such as diabetes mellitus, hypertension, or were taking antipsychotic drugs were not included in the analysis. Following pre-anaesthetic examination, informed consent was taken after informing the study procedure to patients in their native language. A multipara monitor including a 5-lead electrocardiogram, an automated non-invasive blood pressure machine, a pulse oximeter, and a peripheral nerve stimulator were attached in the operation room, and baseline vitals were taken.

The technique of tracheal intubation was as per randomised group. Totally, 34 patients were randomised into two groups (Group A and Group B) using a computer-generated block randomization.

Group A- trachea was intubated following clinical assessment of neuromuscular blockade.

Group B- trachea was intubated following neuromuscular block monitoring by TOF.

On the morning of surgery, the patients were pre-medicated with oral pantoprazole 40 mg after being kept fasted for 6 hours. Patients were given Inj.Fentanyl 2 µg/kg intravenously and Inj.propofol (2mg/kg) was used to induce anaesthesia until the eyelash reflex vanished. After the eyelash reflex had vanished supramaximal TOF stimulus was delivered to the wrist's ulnar nerve by surface electrodes (stimulation current set at 60 mA). After standardising the supramaximal stimulus, 0.1 mg/kg of vecuronium was injected intravenously over a period of five seconds. Following vecuronium injection, sevoflurane and 100% oxygen were used to ventilate the lungs.

In group A, an experienced anesthesiologist evaluated the time of intubation based on clinical judgement beginning 1 min after the administration of the muscle relaxant and continuing every 30 s after that. The time of the laryngoscopy was determined by the tone of the upper airway, jaw, and ease of ventilation. In order to measure jaw tone, the patient's mouth was forced open, whereas the amount of jaw support required to maintain a patent airway was used to measure upper airway tone.

In group B, the anesthesiologist intubated the patients following total loss of all four responses to TOF stimulation (TOF count zero), which was done every 30 seconds beginning from 1 minute after vecuronium was administered. A 60 mA, 2 Hz current running for 0.2 ms was used for the electrical stimulation.

Endotracheal tubes of the proper size were used to intubate the trachea. Over a five-second period, the endotracheal tube's cuff was inflated. It was documented how long it took from the time neuromuscular blocking medications were administered till the time of tracheal intubation and cuff inflation. Patients who underwent oesophageal

intubation were not included in the analysis. Sevoflurane was then used in a mixture of oxygen and nitrous oxide (40:60) to perform mechanical lung ventilation.

The cardiovascular parameters (heart rate, mean arterial pressure) were monitored at T0 –baseline vitals, T1 – immediate after vecuronium administration, T2 – 1 min after vecuronium administration, T3 – after inflation of the cuff following intubation, T4 – 1 min after intubation, T5 – 3 min after intubation, T6 – 5 min after intubation.

Intubating conditions as graded using the Krieg's intubating score, ranging from 3 (best possible intubating conditions) to 12 (worst possible conditions) were noted. [8] The laryngoscopic views were also graded as per Cormack–Lehane (CL) grading.

At the end of surgery neuromuscular blockade reversed with IV inj. Neostigmine (0.05mg/kg bodyweight) and inj. Glycopyrolate (0.01mg/kg bodyweight).

RESULTS

A total 34 patients were included for analysis, and there were no exclusions as none of the patients had oesophageal intubation or required more than one attempt for intubation. The demographic profile was comparable in the two groups.

Table 1. Demographic data of two groups

parameter	Group A (n=17)	Group B (n=17)	P
Gender (M/F)	8/9	7/10	0.451
Age (years)	44±8	47±9	0.167
Weight (kg)	57±9	60±9	0.182
Height (cm)	156±7	156±8	0.719
BMI (kg/m2)	23.6±4.3	24.8±3.5	0.189

The mean HR and mean arterial pressure were higher in Group B as compared to Group A with statistical significance (P < 0.05) at the T3, T4, T5, T6 points of time.

Table 2. The mean heart rate of two groups

TIME	Mean HR Group A (mean+SD)	Mean HR Group B (mean±SD)	P
T0	78.4±4.3	80.3±3.2	0.2479
T1	81.5±5.2	84.2±7.2	0.2039
T2	102.4±1.3	97.2±2.4	0.0189
T3	112.2±1.3	94.6±4.4	<0.0001
T4	118.6±3.6	98.7±7.3	0.0073
T5	99.3±0.8	88.1±4.2	<0.0001
T6	100.2±2.5	84.6±5.3	0.0045

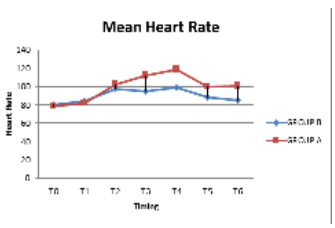

Figure 1: The mean heart rate in the two groups. T0 – Before shifting the patient to OT table (baseline data); T1 – Immediate after vecuronium administration; T2 – 1 min after vecuronium administration; T3 – After inflation of the cuff following intubation; T4 – 1 min after intubation; T5 – 3 min after intubation; T6 – 5 min after intubation

Table 3. The mean arterial pressure of two groups

TIME	Mean Arterial Pressure Group A (mean+SD)	Mean Arterial Pressure Group A (mean+SD)	P
T0	100.56 ± 12.25	98.20 ± 12.96	0.8245
T1	95.76 ± 8.95	93.30 ± 4.90	0.0210
T2	91.36 ± 13.83	88.50 ± 6.38	0.0035
T3	104.48 ± 9.19	94.50 ± 1.65	0.0000
T4	101.44 ± 12.83	93.22 ± 3.48	0.0000
T5	94.54 ± 11.85	85.48 ± 5.35	0.0028
T6	94.53 ± 11.84	85.47 ± 5.34	0.0027

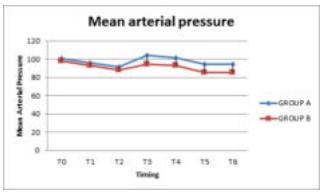

Figure 2: The mean arterial presuure in the two groups. T0 – Before shifting the patient to OT table (baseline data); T1 – Immediate after vecuronium administration; T2 – 1 min after vecuronium administration; T3 – After inflation of the cuff following intubation; T4 – 1 min after intubation; T5 – 3 min after intubation; T6 – 5 min after intubation

Table 4. Study parameters in two groups

PARAMETER	Group A	Group B	P
Mean time from administration of neuromuscular blocking agent and tracheal intubation (S)	177±8 S	365±101 S	<0.0001
CL grading (1:2:3:4) (n)	12:5:0:0	15:2:0:0	0.001
Intubating condition (score 3:4:5) (n)	8:3:6	13:4:0	0.002

The mean time from administration of neuromuscular blocking agent and tracheal intubation was significantly higher in Group B (365±101 S) as compared to Group A (177±8 S) (P < 0.0001). The CL grading was more favourable in Group B as compared to Group A (P = 0.001). The intubating score was better in Group B as compared to Group A (P = 0.002).

DISCUSSION

Laryngoscopy and subsequent endotracheal intubation causes a severe sympathetic stimulation. A variety of responses, such as a motor response, and cardiovascular response is shown by faster heart rate and raised arterial pressure.[11,12]

In our study, patients who were intubated under the direction of neuromuscular monitoring experienced lower mean values of mean arterial pressure and HR during and after intubation compared to patients who were intubated under the direction of clinical judgement (P<0.05). We used vecuronium as muscle relaxant and the result was found in the same direction like the previous study of Rakesh Alur et al[13]. They concluded that complete muscle relaxation guided by neuromuscular monitoring showed statistically significant (P<0.05) decreased haemodynamic response to laryngoscopy and intubation after iv Vecuronium.[13]

It appears that laryngoscopy and intubation induce higher nociceptive stimulation in patients with partial neuromuscular block, leading to a stronger reflex cardiovascular response which is supported by studies of Nandi R et al.[14]and Witkowska M et al.[6]

In this study we used adductor pollicis muscle for assessment of TOF. Adductor pollicis (AP) muscle is used most commonly because of its easy accessibility for visual, tactile and mechanographic assessment and also signifies complete paralysis of laryngeal muscles.[13]

Intubation was attempted at an average of 177 seconds after vecuronium injection in the clinical group, and intubating condition was good in 70% of patients. Positive intubation conditions were discovered in 100% of patients in the neuromuscular monitoring group, where intubation was attempted after an average of 365 seconds of vecuronium administration. Excellent intubation conditions were observed in patients when the moment of intubation was chosen after complete loss of the reaction to TOF stimulation, assessed visually compared to clinical assessment. This findings were in accordance with the studies of Nandi R et al.[14]and Witkowska M et al.[6]

CONCLUSION

Neuromuscular monitoring guided laryngoscopy and intubation provides better intubating condition and reduces the haemodynamic response as compared to conventional clinical assessment.

REFERENCES

1. Kazama T, Ikeda K, Morita K. Reduction by fentanyl of the Cp50 values of propofol and hemodynamic responses to various noxious stimuli. Anesthesiology 1997;87:213-27.
2. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth 1996;8:63-79.
3. Angelard B, Debry C, Planquart X, Dubos S, Dominici L, Gondret R, et al. Difficult intubations. A prospective study. Ann Otolaryngol Chir Cervicofac 1991;108:241-3.
4. Morgan JM, Barker I, Peacock JE, Eissa A. A comparison of intubating conditions in children following induction of anaesthesia with propofol and suxamethonium or propofol and remifentanil. Anaesthesia 2007;62:135-9.
5. Smith I, Saad RS. Comparison of intubating conditions after rocuronium or vecuronium when the timing of intubation is judged by clinical criteria. Br J Anaesth 1998;80:235-7.
6. Witkowska M, Karwacki Z, Wierzchowska J, Bukowski P. Neuromuscular block monitoring for optimisation of conditions for endotracheal intubation. Anestezjol Intens Ter 2009;41:140-4.
7. Fuchs-Buder T, Claudius C, Skovgaard LT, Eriksson LI, Mirakhur RK, Viby-Mogensen J; 8th International Neuromuscular Meeting. Good clinical research practice in pharmacodynamic studies of neuromuscular blocking agents II: The Stockholm revision. Acta Anaesthesiol Scand 2007;51:789-808.
8. Kreig N, Mazur L, Booij LH. Intubating conditions and reversibility of a new nondepolarising neuromuscular blocking agent, Org NC45. Acta Anaesthesiol Scand 1980;24:423-5.
9. Safavi M, Honarmand A. Attenuation of cardiovascular responses to laryngoscopy and tracheal intubation – Intravenous sufentanil vs. pethidine. Middle East J Anaesthesiol 2008;19:1349-59.
10. Fassoulaki A, Melemeni A, Paraskeva A, Petropoulos G. Gabapentin attenuates the pressor response to direct laryngoscopy and tracheal intubation. Br J Anaesth 2006;96:769-73.
11. Stevens JB, Vescovo MV, Harris KC, Walker SC, Hickey R. Tracheal intubation using alfentanil and no muscle relaxant: Is the choice of hypnotic important? Anesth Analg 1997;84:1222-6.
12. Rundshagen I, Schröder T, Prichep LS, John ER, Kox WJ. Changes in cortical electrical activity during induction of anaesthesia with thiopental/fentanyl and tracheal intubation: A quantitative electroencephalographic analysis. Br J Anaesth 2004;92:33-8
13. Alur RT, Anupama MK, Prakash HK. A comparative, randomized clinical study of haemodynamic response to laryngoscopy and tracheal intubation using vecuronium with and without neuromuscular monitoring by peripheral nerve stimulator. Indian J Clin Anaesth 2019;6(1):19-22
14. Nandi R, Basu SR, Sarkar S, Garg R. A comparison of haemodynamic responses between clinical assessment-guided tracheal intubation and neuromuscular block monitoring-guided tracheal intubation: A prospective, randomised study. Indian J Anaesth 2017;61:910-5.