



THE NEUROMUSCULAR BLOCKADE ONSET AND THE INTUBATING CONDITIONS DURING PANCURONIUM INTRODUCTION

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ABSTRACT

The purpose of the study was to compare the occurrence of neuromuscular blockade (NMB) and intubating conditions in two muscle groups orbicularis oculi (OO) and adductor pollicis (AP) in patients who were given pancuronium. Eighty adult patients, aged 15-50 years who were ASA grade I or II and underwent elective surgeries were enrolled. A train-of-four (TOF) stimulation of OO and AP muscles was visually used to determine the time of onset of NMB. The findings demonstrated that NMB monitored at OO gave satisfactory intubating conditions 64 +/- 11.51 seconds before those monitored by AP. Conditions at intubation were equally good in both the groups with Group II (AP) showing a little better result. The time to NMB development at OO was much quicker than at AP with a mean difference of 62.20 12.76 seconds ($p < 0.001$) in both groups. The more rapid onset at OO may be explained by the fact that it has a greater perfusion and is closer to the central circulation than the more peripheral AP muscle. The conclusion of the work is that observation of the development of NMB at the OO muscle can provide a more predictable and earlier sign of the intubating conditions.

Keywords: Neuromuscular blockade, intubating conditions, orbicularis oculi, adductor pollicis, pancuronium

INTRODUCTION

It was observed that inconsistencies exist between the settings of intubation and the level of adductor pollicis (AP) blockade [1-3]. Orbicularis oculi (OO) depicts comparable properties, including the time evolution of neuromuscular blockade (NMB) and muscle relaxant effect on it, just like the laryngeal adductors and the diaphragm [4-6]. As a result, the OO response could be a more valid indicator of the intubating conditions. The study was undertaken to compare visual estimation of the incidence of NMB at OO and AP muscles and also to find out whether monitoring of OO could be used to indicate satisfactory intubating conditions during pancuronium-produced NMB in adults [7-12].

METHODOLOGY

A total of 80 patients aged 15-50 years, ASA grade I or II, scheduled to undertake elective surgeries after providing a written informed consent and approval by the institutional ethics committee were included in the study. The exclusion criteria included the existence of abnormal airways, cardiovascular, respiratory, neuromuscular, hepatic and renal disorders or taking any medication

which affects neuromuscular transmission at the same time. Pre-medication Oral diazepam 0.2 mg/kg, 90 minutes before induction [1-4]. In the operating room, ECG, pulse oximetry, non-invasive blood pressure monitoring was employed. The neuromuscular function was monitored with surface electrodes placed over the ulnar nerve at the wrist and over the face in the temporal branch of the right facial nerve. Following pre-oxygenation, Anaesthesia induction was carried out using intravenous thiopentone 5 mg/kg and fentanyl 2 µg/kg. One hundred percent oxygen was used in assisted ventilation. The halogenated inhalational agents were avoided due to their established effects on the state of intubation [5-8]. It was pancuronium 0.1 mg/kg intravenously. The visual evaluation of ToF stimulation response was done at OO and AP muscles with a stimulation rate of 12 seconds at each, using Fischer and Paykel Healthcare Innervator nerve stimulators and a current intensity of 50 mA. The patients were randomly assorted into two groups consisting of 40 patients. In group I (OO group), intubation was performed when all the four responses of OO were absent. In group II (AP group), intubation was successful at a point where AP responses were fully blocked. The patients were intubated by an independent anaesthesiologist; he did not know the grouping of the patients and the timetable of the NMB. NMB was thought to have occurred when the time difference between administration of pancuronium and the time all four TOF responses disappeared. The intubating conditions were assessed by the Kreig et al.4 scale (Table-1). Statistics were expressed in mean standard deviation. The comparison of onset time at OO and AP within each group was made by the unpaired students t-test [9-12]. With a group sample size of 40, a power of over 95% (1-**) was obtained when the ** value was 0.01 to achieve a difference in abolition time of 30 s between OO and AP responses. In making the comparison, the intubating conditions between the two groups, chi-square test was employed and the level of significance was put at less than 0.05.

RESULTS

Table 1: Comparison of intubating conditions in the two groups.

Intubating Conditions	Group I (OO)	Group II (AP)
Excellent (Class I)	45 (56.3%)	58 (72.5%)
Good (Class II)	28 (35.0%)	15 (18.8%)
Poor (Class III)	7 (8.8%)	6 (7.5%)
Inadequate (Class IV)	0 (0%)	1 (1.3%)
Total	80 (100%)	80 (100%)

Table 2: Comparison of onset time between the two muscles.

Group	Onset Time	Mean Time ± SD	Significance (seconds)
Group I (OO)	Onset OO	150.30 ± 13.45	t = 32.12
	Onset AP	212.50 ± 15.30	p = 0.000 (v.h.s.)
Group II (AP)	Onset OO	151.50 ± 11.22	t = 28.67
	Onset AP	214.10 ± 16.12	p = 0.000

This study was conducted as a comparison of the intubation conditions, as well as the time to onset of neuromuscular blockade (NMB) in two muscles; orbicularis oculi (OO) and adductor pollicis (AP). Table 1 depicts the comparison of the intubating conditions of Group I (OO) and Group II (AP) where 80 patients were admitted in each group. Conditions of intubation in both groups were categorized into four groups namely Excellent (Class I), Good (Class II), Poor (Class III), and Inadequate (Class IV). Group I (OO): Excellent intubating condition was observed in 45 patients (56.3%) and good intubating condition was observed in 28 patients (35%). Smaller figures, 7 patients (8.8 %) were in poor conditions, and no patient was designated as inadequate. In their turn, Group II (AP) demonstrated superior percentage of great intubating conditions, with 58 patients (72.5%) falling into this parametrical range. Good, poor and inadequate intubating conditions were only 15 (18.8%), 6 (7.5) and 1 (1.3) respectively. These findings are pointers that the intubating

conditions were relatively good in Group II and this may be attributed to near total blockade of the AP muscle compared to the OO muscle. Table 2 compares the time of development of NMB in the two muscle groups of the two groups. In Group I, the average time to the development of NMB at OO was 150.30 $\pm$ 13.45 seconds and at AP, it was 212.50 $\pm$ 15.30 seconds and the difference between the two was significant ($t = 32.12$, $p = 0.000$). Similarly in Group II, the mean time to initiate OO was 151.50 $\pm$ 11.22 seconds and that of AP was 214.10 $\pm$ 16.12 seconds with equally significant difference ($t = 28.67$, $p = 0.000$). These results indicate that the occurrence of NMB at the AP muscle was significantly delayed compared to the OO muscle in both groups arguing that the OO muscle might be more suitable to indicate intubating conditions.

Figure1: Comparison of Intubating Conditions Between Groups Group I (OO): n=80 | Group II (AP): n=80

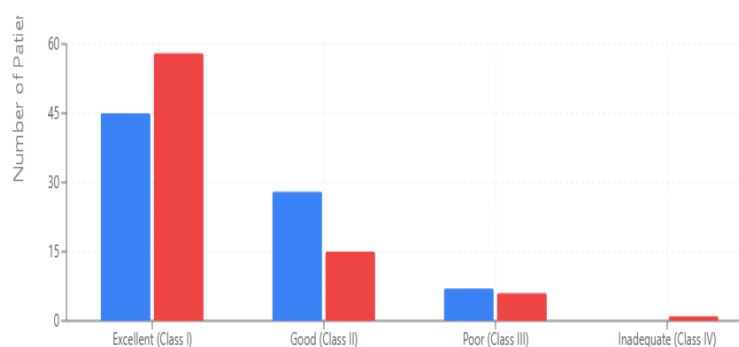
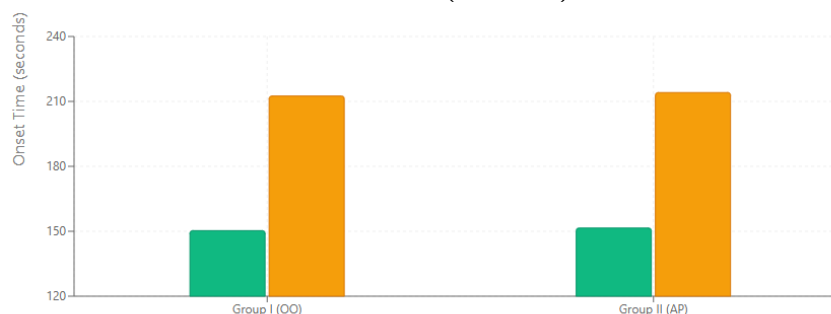


Figure 2: Comparison of Onset Time Between Two Muscles Mean Onset Time $\pm$ Standard Deviation (seconds)



DISCUSSION

This study revealed that monitoring of the progress of 0.1 mg/kg of pancuronium-induced neuromuscular blockade (NMB) at the orbicularis oculi (OO) muscle provided good or excellent intubating conditions 64 $\pm$ 11.51 seconds earlier than monitoring of the adductor pollicis (AP) muscle [1-5]. There was no difference between the two groups as far as the intubating conditions were concerned. The findings of the present study agree with those of previous studies done by Debaene et al. and Plaud et al. The earlier onset of NMB at OO than at AP may be due to shorter circulation time and muscle blood flow proposed by Donati et al [6-8]. The closer the muscles to the central circulation (OO and diaphragm), the higher the overall perfusion, and the quicker the paralysis onset as compared to more distal muscles (AP). The architecture of neuromuscular junction also explains the difference in the sensitivity of muscles to muscle relaxants observed. Goodmurphy et al. described that OO consists of small round fibers and 89 percent of the muscle fibers are fast-twitch type II muscle fibers [9-12]. On the other hand, AP contains slow oxidative fibers.10 In the current study, NMB was visually estimated, as it is less aggressive and more relevant to clinical practice. LeCorre et al, observed that NMB assessed visually gave a good indication of the conditions of intubating. Ungureanuet al. and O'Haraet al. demonstrated close

correlation between visual determination of NMB onset and force recordings. The paper also contributes to the fact that safe intubation could be performed when no visual response at OO is evident after stimulating TOF.

CONCLUSION

It was observed that neuromuscular blockade (NMB) depth at the orbicularis oculi (OO) muscle indicates intubating conditions better and earlier than the adductor pollicis (AP) muscle. The results showed that the difference in onset time of NMB between the two muscle groups was substantial with OO muscle showing quicker onset time that could be attributed to the fact that it is more perfused and nearer to the central circulation. The findings were that perhaps an alternative method of monitoring the optimal conditions of intubation is by monitoring the OO response, which is safer and quicker than the well-established method of monitoring the AP muscle. Nonetheless, the entire conditions of intubation did not vary considerably between the two groups regardless of the accelerated onset at OO, which demonstrated that both OO and AP muscles are adequate subjects through which one can conclude the adequacy of NMB. That visual estimation of NMB as the non-invasive and clinically useful method is the good predictor of intubating conditions was also emphasized in the study, which corresponds with the previous findings of LeCorre et al. as well as with the other findings concerning the visual estimations of NMB onset. Of significance in clinical practice is the prediction of adequate intubating conditions in a quick way mostly in occasions where muscle relaxants like pancuronium are employed. In accordance with the findings, there is a possibility to monitor the OO muscle and carry out intervention earlier and make the intubation process safer. Further research can therefore be conducted on how it is possible to perfection this technique and introduce it into the standard clinical practice so as to simplify use of anaesthesia and achieve improved patient outcomes.

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