The Occurrence of Postoperative Residual Curarization among Post-Coronary Artery Bypass Graft Patients in a Surgical Intensive Care Unit of a Tertiary Hospital

Marion R. Nuevo, MD; Florian R. Nuevo, MD
Philippine Heart Center

Abstract

BACKGROUND: Intermediate-acting muscle relaxants have gained favor in fast-track cardiac anesthesia since these are associated with early extubation. However, postoperative residual curarization (PORC) still occur in the post anesthesia care unit. This study aims to determine the occurrence of PORC among post-coronary artery bypass graft (CABG) patients in the surgical intensive care units (SICU) of the Philippine Heart Center.

METHODS: A cross-sectional study was undertaken among 60 patients for elective CABG surgery. Within an hour from SICU arrival, Train of Four (TOF) ratio was obtained and a value of <0.7 signified the presence of PORC.

RESULTS: 57 out of 60 (95%) were found to have PORC. Patients without PORC were significantly warmer (36.4°C vs 34.8°C, p-value=0.019) upon SICU arrival compared to those with PORC. The duration of ventilatory support was significantly longer in those with PORC (510 min vs 305 mins, p-value=0.021). The rocuronium induction dose and duration of infusion did not differ between those with and without PORC while the use of reversal drug was seen to significantly prevent its occurrence (p-value=0.003).

CONCLUSION: This study showed a high incidence of PORC among post-CABG patients in the SICU with the current practice of Rocuronium infusion during surgery. The use of muscle relaxant reversal drug was seen to significantly prevent the development of PORC while higher body temperature upon SICU arrival was observed in patients that did not develop PORC. This study was also able to show that the development of PORC prolonged post-operative mechanical ventilatory support hindering the goals of fast-track cardiac surgery.

INTRODUCTION

Fast track cardiac anesthesia, now known as Enhanced Recovery After Cardiac Surgery (ERACS) integrates the practice of early tracheal extubation and promotes a decrease in the number of days in the intensive care unit (ICU). These in effect lessens the total duration of hospital stay contributing to cost reduction in cardiac surgery and have shown to be safe for patients.[1-7] The demand for ERACS affects all aspects of cardiac anesthesia and behooves cardiovascular anesthesiologists to re-evaluate their current perioperative strategies. Short or intermediate-acting muscle relaxants are thus preferred since these drugs are associated with early extubation and reduced symptoms of residual paresis.[3] However, despite the use of shorter-acting muscle relaxants, residual muscle paralysis or postoperative residual curarization (PORC) do occur in the post anesthesia care unit among fast-track cardiac surgery patients.[4]

Currently, there are no guidelines for the dosing, monitoring and reversal of muscle relaxants in fast track cardiac anesthesia. An expert consensus for optimal perioperative care in cardiac surgery was released last 2018 by the ERAS Cardiac Surgery Society; however, no recommendations were given regarding the dosing, monitoring, and reversal of neuromuscular blockade.[5] In most institutions, muscle relaxants are given as continuous infusion intra-operatively and the use of neuromuscular blockade monitoring and reversal are not part of routine standards of care during cardiac surgery. In addition, there has not been any local study regarding the incidence of postoperative residual curarization and its contributing factors among cardiac surgery patients.

With this study, the data obtained can help determine if PORC does occur in post-coronary artery bypass graft patients in a tertiary hospital. This study shall encourage a review of the current anesthesia practice particularly with regards to the use of muscle relaxants, their delivery, and monitoring. Also, the data from this research can contribute to the improvement of the current routine practices of anesthesia in cardiac surgery. Lastly, our observations may also contribute to the practice guidelines regarding the use of neuromuscular blocking drugs in fast-track cardiac anesthesia and ERACS.

This study aimed to determine the occurrence of PORC among post-coronary artery bypass graft (CABG) patients in a surgical intensive care unit (SICU) of a tertiary hospital. The train-of-four (TOF) ratio upon SICU arrival was measured to determine the incidence of PORC. Also, perioperative data such as rocuronium intraoperative dose, dose infusion, and infusion duration were determined and compared among those with and without PORC. Lastly, contributing factors to PORC occurrence were also noted.

METHODS

A cross-sectional study was undertaken last November 2019 to September 2020 at the surgical intensive care units 1 and 2 of a tertiary hospital upon approval from the IERB. A minimum of 56 patients was required for this study based on 66% prevalence of residual neuromuscular blockade, 5% level of significance, and 12.5% desired half-width of the confidence interval.[8,10]

The following were included in this study: Filipino male or female patients, aged 19 years old and above who were able to give informed consents a day prior to their elective CABG surgery. These patients must have been given rocuronium intra-operatively and must have been admitted at the surgical intensive care units for further postoperative monitoring and management. Patients that were excluded from the study were those with an ejection fraction of less than 30%, with preoperative use of inotropes or intra-aortic balloon pumps, patients with severe chronic pulmonary disease, patients with known renal, hepatic, and neuromuscular diseases.

The informed consent was obtained at least a day before their scheduled surgery in the patient's respective ward where they were admitted. The principal investigator conducted the process for the informed consent as long as she was not the primary anesthesiologist of the surgery of the patient being recruited. The process of informed consent for this study was done separately from the process of informed consent for the surgery.

Within an hour of the admission of qualified subjects at the surgical intensive care unit, the principal investigator measured the train-of-four ratio of the patients using a TOF watch. An acceleromyograph was utilized to obtain the TOF ratio or TOF count using the adductor pollicis muscle of the hand. The strength of the contraction of the adductor pollicis, as well as the number of the detected muscle twitches, were then measured. Three readings were obtained and the average of the three measurements was reported. A TOF count of 0 to 4 or a TOF ratio of <0.7 signified the presence of postoperative residual curarization or residual paralysis in this study.

Identification of Study Variables

The occurrence of postoperative residual curarization among post-op CABG patients was the dependent or outcome variable in this study. This was determined by the presence of a TOF ratio <0.7 upon arrival at SICU. After which, subjects were divided into those with PORC and those without PORC.

Independent or exposure variables of this study on the other hand were the following: total dose of Rocuronium given intraoperatively, dose of rocuronium infusion and duration of Rocuronium infusion.

Confounding variables in this study were hypothermia, prolonged anesthesia time or prolonged exposure to sevoflurane, and the sedative effects of opioids and benzodiazepine. All of these are known to be synergistic to the effects of muscle relaxants and may contribute to the occurrence of postoperative residual curarization.

Definition of Terms

Induction dose – bolus dose of rocuronium given before

intubation
Infusion dose – dose of rocuronium infusion used intraoperatively
Duration of anesthesia – duration from the time sedation is first given at the operating room until the time patient is transported out of the operating room
Duration of infusion – time from the start of rocuronium infusion until the time it is discontinued
Duration of surgery – duration from cutting time until the end of skin closure
Post-operative residual curarization – residual muscle paralysis, determined by the presence of TOF ratio < 0.7 and TOF count 0 to 4
TOF Count – the number of detected muscle twitches, ranges from 0 to 4. If TOF count is 4, a TOF ratio can be measured.
Train of Four Ratio–When there are 4 muscle twitches produced after stimulation, the ratio of the strength of the fourth muscle twitch to the first one can be measured

Statistical analysis
Descriptive statistics was used to summarize the demographic and clinical characteristics of the patients. Frequency and proportion were used for categorical variables, median and interquartile range for non-normally distributed continuous variables, and mean and SD for normally distributed continuous variables. Fishers Exact test for categorical variables and Wilcoxon rank-sum test for continuous variables were used to determine the difference between patients with and without PORC. With further analysis using simple logistic regression, odds ratio and corresponding 95% CI were computed to determine significant contributing factors of PORC. Null hypotheses were rejected at 0.05 α-level of significance and STATA 13.1 was used for data analysis.

RESULTS

A total of 60 patients were included in the study and only 3 out of 60 (5.0%) are without PORC while 57 out of 60 (95%) were

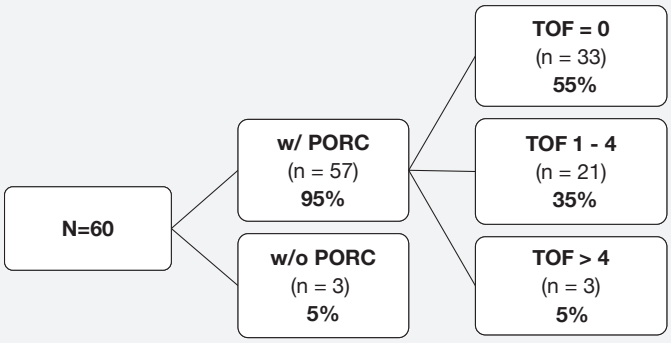

Figure 2. Incidence of PORC

Table 1. Demographic and Procedural Profile of the Patients

	Without PORC n=3	With PORC n=57	P-value
	Frequency (%); Mean ± SD; Median (IQR)		
Age	56.0±12.3 61.0 (11.5)	58.5±8.1 60.0 (12.0)	0.852
Sex			
Male	3 (100.0%)	47 (82.5%)	1.000
Female	0 (0.0%)	10 (17.5%)	
Weight (kg)	70.0±8.7 66.0 (8.0)	70.8±11.7 68.5 (13.9)	0.959
Height (cm)	162.0±4.4 160.0 (4.0)	163.4±8.3 163.0 (10.0)	0.734
BMI	27.0±4.6 26.0 (4.5)	26.4±3.2 26.0 (5.0)	0.932
Co-morbidities			
Hypertension	1 (33.3%)	34 (59.6%)	0.565
Diabetes Mellitus	0 (0.0%)	28 (49.1)	0.241
Duration of CPB (mins)	166.7±50.2 154.0 (49.0)	107.8±66.0 122.0 (43.2)	0.118
Duration of AXC (mins)	115.0±48.8 98.0 (46.5)	89.0±56.1 97.5 (53.5)	0.665
Duration of Surgery (mins)	325.3±40.2 330 (40.0)	393.5±78.9 390 (97)	0.635
Duration of Anesthesia (mins)	380.0±53.3 360 (50.5)	336.7±68.6 335 (78.0)	0.709

found to have residual paralysis in the immediate postoperative period at the SICU. Those with PORC were further divided based on their TOF count as shown in Figure 2. Three out of the 57 (5.0%) had TOF > 4, 21 out of the 57 (35.0%) had TOF 1-4 and 33 out of the 57 (55.0%) had TOF 0.

There was no significant difference with regards to the demographic profile of the patients in both groups as well as in the duration of bypass, cross-clamp, surgery, and anesthesia times as shown in Table 1.

As shown in Table 2, the rocuronium induction dose and duration of rocuronium infusion among patients without PORC was comparable with those with PORC. The rocuronium infusion dose was not consistently reflected in the anesthesia records hence the total rocuronium dose was not obtained in both groups. Intraoperative TOF monitoring was not done in all patients included in this study. Lastly, there was a significant difference in the proportion that used the drug Sugammadex, a muscle relaxant reversal, between those without PORC (66.7%) and those with PORC (1.7%) (p-value= 0.005).

All patients in this study received fentanyl and midazolam intraoperatively. The median Fentanyl dose and the median Midazolam dose of the patients without PORC was comparable with those with PORC. For the intraoperative temperatures of the subjects in this study, there was likewise no significant difference between the two groups as shown in Table 3.

The postoperative recovery data is shown in Table 4. The median TOF ratio in patients without PORC was 81% while the median TOF count in those with residual paralysis was 1.0. In both groups, the majority of the patients were still sedated upon arrival at SICU. Patients without PORC were significantly warmer (36.4°C, IQR=0.6) compared to those with PORC (34.8°C, IQR=1.2) (p-value=0.019). The duration of the interval between SICU arrival and weaning as well as the duration of ventilatory weaning in patients with PORC was longer but did not differ significantly from those without PORC. However, the duration of ventilatory support was significantly shorter in those without residual paralysis (305 min, IQR=108.5) compared to those with PORC (510 min, IQR=645.0) (p-value=0.021). None of the patients without PORC were reintubated while 2 (3.5%) among those with PORC were reintubated. Lastly, the duration of ICU stay of the patients without PORC was shorter but not significantly different from those with PORC.

With further analysis, only the use of reversal drugs was seen to be significantly associated with the occurrence of PORC (p-value=0.003). The use of reversal drugs significantly reduced the likelihood of PORC by 0.009 times (95% CI= 0.0004 to 0.2).

DISCUSSION

This study showed an incidence of postoperative residual paralysis among post-CABG patients in the SICU to be 95.0%. The induction dose and infusion duration of rocuronium did not affect the occurrence of PORC. While the use of reversal

Table 2. Intraoperative Rocuronium Data

	Without PORC n=3	With PORC n=57	P-value
	Frequency (%); Mean ± SD; Median (IQR)		
Induction Dose (mg/kg)	0.97±0.29 0.80 (0.25)	0.79±0.22 0.80 (0.10)	0.168
Infusion Duration (min)	292.7±31.5 286.0 (31.0)	315.5±71.9 306.0 (88.0)	0.487
Intra-op TOF Monitoring	0	0	-
Rocuronium Reversal	2 (66.7%)	1 (1.7%)	0.005

Table 3. Intraoperative Opioid, Benzodiazepines, Inotropes and Temperature

	Without PORC n=3	With PORC n=57	P-value
	Frequency (%); Mean ± SD; Median (IQR)		
Fentanyl Dose	8.0±4.3 7.6 (4.3)	8.5±4.3 7.8 (5.5)	0.852
Midazolam Dose	0.08±0.06 0.04 (0.06)	0.07±0.04 0.07 (0.05)	0.758
Temperature Range			
Highest	36.4±0.2 36.3 (0.2)	36.0±0.5 36.0 (0.8)	0.126
Lowest	31.6±1.0 32.0 (0.9)	31.4±2.0 32.0 (2.2)	0.671

Table 4. Postoperative Recovery Data

	Without PORC n=3	With PORC n=57	P-value
	Frequency (%); Mean ± SD; Median (IQR)		
TOF Ratio/Count at SICU	82%±8% 81% (8%)	1.2±1.1 1.0 (1.7)	-
Level of consciousness Awake Drowsy Sedated	 0 (0.0%) 1 (33.3%) 2 (66.6%)	 0 (0.0%) 10 (17.5%) 47 (82.5%)	0.462
Temperature at SICU	36.0±0.7 36.4 (0.6)	34.6±1.0 34.8 (1.2)	0.019
Interval from SICU Arrival to Weaning (mins)	140.7±105.1 100.0 (99.0)	480.7±552.4 290.0 (285.0)	0.053
Duration of Ventilatory Weaning (mins)	180.0±143.1 105.0 (127.5)	305.8±404.3 175.0 (185.0)	0.270
Duration of Ventilatory Support (mins)	300.7±108.6 305.0 (108.5)	858.1±886.8 510.0 (645.0)	0.021
Reintubation	0 (0.0%)	2 (3.5%)	1.000
SICU Stay (hours)	43.7±5.9 46.0 (5.6)	63.9±48.9 47.3 (23.7)	0.476

Table 5. Factors of PORC

Factors	Odds Ratio	95% CI	P-value
Induction dose	0.1	0.005 to 3.3	0.217
Infusion duration of rocuronium	1.0	0.99 to 1.0	0.578
Use of reversal drug	0.009	0.0004 to 0.2	0.003

drug however was seen to be significantly associated with the incidence of PORC wherein it was shown to be a preventive factor. Upon SICU arrival, those with residual paralysis had significantly lower body temperatures compared to those without PORC. The duration of mechanical ventilatory support was found to be significantly shorter in those without PORC. No difference was seen between those with PORC and those without PORC in terms of sedation doses, intraoperative body temperatures, level of consciousness in SICU, the interval between SICU arrival and weaning, duration of ventilatory weaning, and length of SICU stay.

The use of muscle relaxants is an essential and non-negotiable component of anesthesia because these drugs facilitate not only good airway control, smooth endotracheal intubation, and ventilation, but also ensures good surgical operative conditions which include surgical immobilization and optimal surgical field.[6] In cardiac anesthesia, the perioperative use of muscle relaxants enables smooth quick induction, counteracts opioid-induced rigidity seen during opioid induction, decreases oxygen consumption during cardiopulmonary bypass (CPB) and prevents hypothermia-induced shivering.[7]

Residual curarization or residual neuromuscular blockade is defined as the inadequate neuromuscular recovery as measured objectively thru neuromuscular monitoring, like the 'Train of Four'. A residual block is present when the train-of-four (TOF) ratio is less than 0.7, in some literature 0.9.[4] Unfortunately, without proper neuromuscular monitoring, residual blockade is a commonly unrecognized complication in the early postoperative period and has been associated with awake-paralysis, generalized weakness, weakness of upper airway muscles, airway obstruction and impaired pharyngeal function.[8] Furthermore, such has been shown to increase the risk of aspiration, impair the hypoxic ventilatory response and lead to inadequate recovery of pulmonary function, all of these contributing to critical respiratory events, which sometimes even lead to a re-intubation and resumption of mechanical ventilation.[4,10]

In the meta-analysis of Naguib et al (24 trials with 3375 patients), findings showed that approximately 40% of patients receiving intermediate-acting neuromuscular blocking drugs during their operation had a TOF ratio <0.9 in the post-anesthesia care unit.[9] Roy et al in his observational study reported a 66% incidence of PORC among fast-track cardiac surgery.[8] In the current study, the 95% incidence of PORC was higher compared to previous literature.

Rocuronium, an intermediate-acting neuromuscular blocking agent, has been shown to reduce tracheal extubation times and symptoms of residual paresis when compared to longer-acting muscle relaxants such as pancuronium.[7,11] However, no other studies were found which determined the association of rocuronium induction dose and infusion duration with PORC in a group of post-coronary artery bypass graft patients. This study showed a lack of significant association between the induction dose of rocuronium as well as the duration of rocuronium infusion and PORC. The lack of association however may be due to the limitation of the study wherein only a small number of patients did not develop PORC (three only) resulting in reduced power of the statistical analysis.

Cardiopulmonary bypass contributes to an increased risk of residual muscle paralysis in the immediate postoperative period because of the effects of CPB on the pharmacokinetics and pharmacodynamics of muscle relaxants. The CPB-related factors include the increased sensitivity of the neuromuscular junction to muscle relaxants, the decreased drug metabolism, and the decreased elimination by the liver and kidneys, particularly during hypothermic CPB or in patients with deranged liver and renal functions. Other factors that contribute to the prolongation of the effects of neuromuscular blockers in cardiac surgery are the altered volumes of distribution during CPB and the decreased concentrations of calcium and magnesium. In this study, the duration of CPB did not show to contribute to the occurrence of PORC.

Other conditions that enhance muscle paralysis based on studies are the following: prolonged exposure to volatile anesthetics, hypothermia, and large doses of opioids intra-operatively.[12,13] These were not consistently seen in this study since the duration of anesthesia, the doses of the sedative drugs used as well as the intraoperative temperatures of the subjects did not differ from those that developed PORC compared to those that did not. However, body temperatures upon SICU arrival of subjects that developed PORC were seen to be significantly lower (34.6 versus 36.0, p-value = 0.019).

A very crucial aspect when administering continuous muscle relaxant infusion is the determination of the depth of neuromuscular blockade which can be objectively done by using the 'train of four' (TOF) ratio. The routine practices of emphasis on hemodynamic management, with inattention for monitoring objectively the depths of paralysis and preference for NMB continuous drug infusion techniques, predispose cardiac surgery patients to the occurrence of residual paralysis in the immediate postoperative period.[4,7,14] In a national survey done by Murphy et al, only 28% of cardiac anesthesiologists routinely monitor the neuromuscular blockade in the operating room and only 8% routinely reverse muscle paralysis postoperatively.[10] In this study, TOF monitoring was not done and only 3 of out the 60 patients received a reversal agent at the end of surgery. There was a significant difference in the proportion that used a muscle relaxant reversal between those without PORC (66.7%) and those with PORC (1.7%) (p-value=0.005). Further analysis also revealed that the use of reversal drug was seen to be significantly associated with the occurrence of PORC (p-value=0.003), significantly reducing the likelihood of PORC by 0.009 times (95% CI= 0.0004 to 0.2). Hence, the lack of intraoperative TOF monitoring, as well as the non-preferential use of muscle relaxant reversal, may be the reasons behind the high incidence of PORC in this study.

Adverse respiratory events in the immediate postoperative period, namely reintubation, upper airway obstruction, and the need for airway support, are related to a multiplicity of causes and several studies have been made associating these with the occurrence of postoperative residual paralysis.[15] In this study, the median duration of ventilator support was indeed significantly longer among those with PORC (510 minutes vs 305 minutes, p-value=0.021).

Fast Track Cardiac Anesthesia or ERACS is a popular recent development in the perioperative management and anesthesia care for cardiac surgery. One of its goals is to decrease ICU length of stay by practicing early tracheal extubation. The occurrence of PORC in post-CABG patients is a hindrance to this objective. The results of this observational study have shown the importance of reversing muscle paralysis, keeping our patients normothermic, and monitoring the depth of paralysis as important considerations in managing patients for fast-track cardiac surgery that are on continuous rocuronium infusion intraoperatively. However, further studies with a larger sample size are needed to validate the findings of this study and improve the generalizability of the results.

A randomized control trial comparing different rocuronium doses and comparing different modes of rocuronium administration that will prevent the occurrence of PORC is recommended. Also, a randomized control trial to determine if the use of intraoperative TOF monitoring and if the use of muscle relaxant reversal will prevent the occurrence of residual paralysis is advised.

LIMITATION

This study was being carried out when the COVID-19 pandemic ensued. This limited the subjects to the minimum required study participants and prevented a larger sample size. A larger sample size would improve the generalizability of results and would allow the execution of studies that determine causes of residual muscle paralysis.

CONCLUSION

This study showed a high incidence of postoperative residual paralysis among post-CABG patients in the SICU of a tertiary hospital. The lack of intraoperative TOF monitoring, as well as the non-preferential use of muscle relaxant reversal, may be the reasons behind this. Also, this study was able to show that the development of PORC prolonged post-operative mechanical ventilatory support hindering the goals of ERACS. This study failed to show that the current practice, with regards to the rocuronium induction dose and its infusion duration, contributes

to the occurrence of PORC. Lastly, the use of muscle relaxant reversal drug was seen to significantly prevent the development of PORC, and higher body temperature upon SICU arrival was observed in patients that did not develop residual paralysis..

REFERENCES

1. Hemmerling TM, Russo G, Bracco D. Neuromuscular blockade in cardiac surgery: An update for clinicians. *Ann Card Anaesth* 2008; 11:80-90
2. Murphy GS, Szokol JW, Marymont JH, Avram MJ, Vender JS, Rosengart TK. Impact of Shorter-acting Neuromuscular Blocking Agents on Fast-track Recovery of the Cardiac Surgical Patient. *Anesthesiology* 2002; 96:600-6
3. Hemmerling TM, Zaouter C. Neuromuscular blockade and outcome in cardiac anesthesia. *Ann Card Anaesth* 2010; 13:189-91
4. Aytac I., Asyun P., Aytac B., Sacan O., Alay GH., Celik B. et al. Survey of postoperative residual curarization, acute respiratory events and approach of anesthesiologists. Rev Bras Anestesio. 2014; 66(1):55-62
5. Engelman DT, Boyle EM, Williams JB, Perrault LP, Reddy VS, Arora RC et al. Enhanced Recovery After Surgery: An Expert Consensus Statement in Cardiac Surgery. April 28, 2018. Available from: https://www.erascardiac.org/recommendations/expert-recommendations
6. Moi D. Residual Neuromuscular Blockade. Anaesthesia Tutorial of the Week 290. August 26, 2013. Available from: http://www.totw.anaesthesiologists.org
7. Cammu G. How rational is muscle relaxation during cardiac surgery? *Acta Anaesth Belg*, 2007;58:7-14
8. Roy M, Morisette N, Girard M, Robillard N, Beaulieu P. Postoperative awake paralysis in the intensive care unit after cardiac surgery due to residual neuromuscular blockade: a case report and prospective observational study. *Can J Anesth* 2016; 63:725-730
9. Naguib M, Kopman A, Ensor J. Neuromuscular monitoring and postoperative residual curarisation: a meta-analysis. *Br J Anaesth* 2007;98(3):302-316. doi:10.1093/bja/ael386
10. Murphy GS, Szokol JW, Vender JS, Marymont JH, Avram MJ. The use of neuromuscular blocking drugs in adult cardiac surgery: results of a national postal survey. *Anesth Analg* 2002; 95:1534-9
11. Murphy G, Szokol J, Marymont J, Vender J, Avram M. Recovery of Neuromuscular Function Following Cardiac Surgery: Pancuronium Versus Rocuronium. *Anesthesiology* 2002;96(Sup 2):A164. doi:10.1097/00000542-200209002-00164
12. Norton M., Xara D., Parente D., Barbosa M., Abelha F.J. Residual Neuromuscular block as risk factor for critical respiratory events in the post anesthesia care unit. *Rev Esp Anestesiol Reanim* 2013;60(4):190-196
13. Grosse-Sundrup M., Henneman J., Sandberg W., Bateman B., Uribe J., Ngyuen N., Ehrenfeld J., Martinez E., Kurth T., Eikermann M. Intermediate acting non-depolarizing neuromuscular blocking agents and risk of postoperative respiratory complications: prospective propensity score matched cohort study. *BMJ* 2012; 345:e6329
14. Hemmerling TM, Zaouter C. Neuromuscular blockade and outcome in cardiac anesthesia. *Ann Card Anaesth* 2010; 13:189-91
15. Cammu G, Neyens E, Coddens J, Van Praet F, De Decker K. Postoperative residual curarisation is still an issue when weaning patients in intensive care following cardiac surgery. *Anaesth Intensive Care* 2018;46(6):634-636.