

EFFECTS OF PARALYZING AGENT AND MECHANICAL VENTILATION ON RAT DIAPHRAGM FUNCTION

Yannick Hallemans, Osteopath D.O.

ABSTRACT

Objective: Neuromuscular blocking agents are frequently used in the intensive care setting although they may result in complication such as prolonged paralysis and acute quadriplegic myopathy syndrome. We examined whether rocuronium combined with mechanical ventilation (MV) would further alter diaphragm function compared to MV. Design: Randomized controlled experiment. Setting: Animal basic science laboratory. Subjects: 79 male Wistar rats, 14 weeks old. Interventions: Anaesthetized and tracheotomized rats were submitted to either 24h spontaneous breathing (SB, n=8 out of 40), or 24h continuous controlled mechanical ventilation combined with saline administration (CMV, n=9 out of 18), or with rocuronium (MVR, n=9 out of 22). They were compared to control animals free of intervention (C, n=9). Measurements and Main results: While arterial blood gases, and blood pressure were similar between the groups, there was a downward shift of the diaphragm force-frequency curve in the CMV group compared to SB and C and this decrease in diaphragm force was significantly more pronounced in the MVR group compared to CMV (e.g. at 160Hz: -20% and -41% for CMV and MVR, respectively, $p < 0.05$). This was associated with a significant decrease in diaphragm type IIx/b fiber dimension in the CMV (-27%) and also in the MVR group (-35%) compared to control and SB. There was also a significant increase in the Type IIx/b proportion in MVR compared to SB. In both MV and MVR group, diaphragm content of H₂O₂ was similarly increased compared to the Control and SB group. Conclusions: 24h of MV combined with rocuronium leads to a further decrease in diaphragmatic muscle force and a rapid diaphragmatic atrophy of IIx/b fibers compared to MV alone. The mechanisms from these effects still remain to be determined. The extent to which rocuronium would exert deleterious effects in patients under MV is not known but, it seems reasonable to avoid the use rocuronium in these patients.

Keywords: Rocuronium, NMBA, contractile properties, diaphragmatic muscle dysfunction, weaning