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| PURPOSE | 1. Objectives 2. Safety:   No increase in incidence of residual post-anesthesia muscle weakness as measured by:  (a) patients delivered to the PACU intubated  (b) patients in the PACU re-intubated |
| POLICY | Guidelines for the Use of Neuromuscular Blocking Drugs |
| PROCEDURE OR GUIDELINES | A. **Linkage #1**: Objectives can be attained by identifying which subsets of patients require nondepolarizing neuromuscular relaxants (NDMR's) and by recognizing that varying levels of relaxation may be required depending on the case type.  Selection of Patients who Require No Neuromuscular Blockade  Not Needed Intermittent Profound  Integumentary Intra-abdom Open Eyes  Breast Intra-thoracic  Intracranial  B. **Linkage #2**: Monitoring neuromuscular blockade optimizes the safe use of NDMR's. (1)  Principles of Monitoring:  1) Monitoring of thumb is preferred  ulnar nerve at wrist; quantitative monitoring using an accelerometer is the gold standard and should be used in high risk situations.  vis/palp assessment of thumb adduction may be used  train-of-four; counting twitches = train-of-four count  T1, T2, T3, T4  2) Administration of MR should be based on clinical indications and guided by assessment of response to neuromuscular monitoring  3) Train-of-four checked prior to administration of NDMR (to detect prolonged response to succinylcholine)  4) Optimal relaxation (assuming adequate background anesthetic) = T1-T2 present in train-of-four count  5) Knowledge of ED95 (anesthesia background dependent)  onset time  duration  6) The deeper the block, the tougher it is to antagonize (see antagonism algorithm, Table 2)  T0 = unantagonizable block  T1 only = antagonizable but difficult, drug dependent and takes 12-20 min or longer  T1, T2 present = not readily antagonizable  T1, T2, T3 or T1, T2, T3, T4 present = best situation antagonizable  7) Detecting adequate reversal is difficult:  measured train-of-four best > DBS "no fade" > train-of-four "no fade"... others unreliable. Clinical criteria such as sustained head-lift x 5 sec or sustained hand grasp x 5 sec are unreliable  C. **Linkage #3**: Dosing of NDMR's is based on formula.  Principles of Dosing:  1) Need to know ED95, onset time, duration of relaxation (Cis = 0.05 mg/kg; Roc =0.30 mg/kg)  2) Know when relaxation is needed (see B above)!  3) Give ED95 x 2 initially (assuming patient already intubated using sux)  4) Wait duration of onset time, check train-of-four count  5) If train-of-four count > 2 at onset time dose ED95 x 1 again  6) Titrate drug to therapeutic window (0 - T1-T2 present only) during period of required relaxation  7) Allow as much recovery as possible prior to antagonism of block  8) Antagonize block with neostigmine 0.04-0.07 mg/kg  glycopyrrolate 0.01 mg/kg (see table 2)  9) Dosing principle: when you have an unantagonizable block, the excess blood level of drug contributes to waste of drug  10) Use of volatile anesthetics reduce the requirement for neuromuscular blocking drugs in a dose-related fashion (1 MAC reduces ED95 by approx 1/3)  D. **Linkage #4**: Drug selection can be effectively guided by an algorithm (see algorithm/ Table 1).  Drug Selection Criteria  General principle: In the elderly, or those with impaired renal function, and/or complicated metabolic/electrolyte profile a drug which is independent of organ (kidney or liver) elimination is preferable (cisatracurium).  Background information: Drug selection based on following criteria:  1) Patient criteria: Age, renal function  2) Indication of rapid sequence when sux contraindicated  3) Case duration criteria; includes wt.  4) Liver disease is not considered a clinically meaningful selection criteria. If severe liver disease, cisatracurium is probably best.  5) Potential cardiovascular effects are not considered a clinically meaningful **drug selection** criteria. Please note however, it is an important dosing consideration.    E. General Drug Selection Guidelines:  Cisatracurium   1. presence of renal failure 2. > 70 years old 3. when complete reversal of NMB is absolutely essential at end of case   e.g. full stomach, morbid obesity, difficult airway, etc. (see chart #1)   1. duration of case 35-60 or more minutes   Rocuronium   1. for rapid onset when succinylcholine is contraindicated 2. for short cases (give 0.35 mg/kg once)   F. **Linkage #5** Antagonism of Neuromuscular Blockade can be guided by algorithm (see Table 2) following 6 basic principles:  1) No twitches present in the T.O.F. count represents and unantagonizable block  2) Deeper blocks (e.g. T1 only present) are more difficult to antagonize than blocks where T2, T3 or T4 twitches are present in T.O.F. Count T4 present with no fade is best  3) Neostigmine is more effective than edrophonium in antagonizing deep blocks  4) Adequate restoration of neuromuscular function occurs when the quantitative T.O.F. Ratio is > 0.9. Clinical signs of adequate restoration of neuromuscular function are unreliable (5-sec head lift and 5-sec hand grasp)  5) "No detectable fade” of DBS (Double Burst Stimulation) is the most reliable non-quantitative twitch monitoring sign of adequate restoration of neuromuscular function  6) Combining knowledge of # of twitches in T.O.F. Count present at time of reversal, the relaxant being antagonized and time since reversal can enhance the accuracy of detecting adequate restoration of neuromuscular function |
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**APPROVING BODY and POLICY APPROVAL DATE:**

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| **Approved by:** | **Date:** |
| **Stephen M. Rupp, MD** | October 1994 |
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| **Reviewed/Revised by:** | **Date:** |
| **Stephen M. Rupp, MD** | December 1995; March 1999; Fall 2002; Fall 2011; October 15, 2012; September 16, 2013; October 2014; April 21, 2016 |

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