

STANDARD OPERATING PROCEDURE

TITLE: Anaesthetic Monitoring – Animals Under Neuromuscular Blockade (NMB)
SOP NO.: 351-02
REVISION: 02
EFF. DATE: February 2010
SUPERSEDES: NA

APPROVALS

Prepared by (print name): _____ Dept.: _____

Signature: _____ Date: _____

Reviewed by (print name): _____ Dept.: _____

Signature: _____ Date: _____

Approved by (print name): _____ Dept.: _____

Signature: _____ Date: _____

1.0 PURPOSE

- 1.1 This SOP pertains to the use of non-depolarizing neuromuscular agents only.
- 1.2 These agents do not alter consciousness or provide analgesia. In order to prevent severe physical and emotional distress it is imperative that animals are adequately anaesthetized and appropriately monitored while under the effects of muscle relaxants. Failure to do so is a serious offence according to the requirements of **University Council on Animal Care**, the guidelines of the **Canadian Council on Animal Care**, the **Ontario Animals for Research Act** and the **Criminal Code of Canada**. If this SOP is not followed, specific procedures must be detailed in the “Animal Use Application” or related renewals or modifications.
- 1.3 The use of anaesthesia combined with restraint (without the use of paralytic drugs) must be considered and evaluated.

2.0 PROCEDURES

- 2.1 Prior to Study
 - 2.1.1 If injectable anaesthetic will be used:
 - 2.1.1.1 The duration of anesthesia in the specific age, strain and sex used in the experiment must be assessed in advance;
 - 2.1.1.2 Supplemental doses of anaesthetic must be administered as indicated by this assessment.
 - 2.1.2 If inhalation anaesthetic is used;
 - 2.1.2.1 The responsible individual must know and understand the definition of the term MAC, its effect on anesthesia, and must know the MAC for the specific species they are using.
 - 2.1.2.2 The percentage of anaesthetic should be between 1.3 MAC (MAC intubate¹) and 1.5 MAC (MAC BAR²)
 - 2.1.3 All animals undergoing neuro-muscular blockade must undergo endotracheal intubation.

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- 2.1.4 A mechanical ventilator must be used and individuals involved in the procedure must be familiar with the use of the ventilator prior to the study.
- 2.2 Prior to Blockade
- 2.2.1 Animals must not receive paralytic drugs unless this is required by experimental design. The use must be scientifically justified in an approved “Animal Use Protocol”.
- 2.2.2 The plane of anaesthesia must be assessed as adequate by a trained individual and be stable prior to any animal receiving a neuromuscular blocking agent. This period of stabilization should be used to establish and test the monitoring responses that will be in place during blockade.
- 2.2.3 If surgery has been performed, analgesia must be appropriate for the type of surgery, the maximum duration of the neuromuscular blockade and post-operative requirements as indicated in the approved AUP.
- 2.2.4 A reversal agent for the paralytic agent must be immediately available in case of an unexpected reaction. In addition, other supportive drugs must also be available.
- 2.2.5 Artificial ventilation must be established prior to the administration of the drug.
- 2.3 During Blockade
- 2.3.1 Depth of anaesthesia must be assessed at induction and at least every 10 minutes by an individual with training in anesthetic monitoring to ensure that a change in depth has not occurred. Parameters measured will be dependant on monitoring capabilities.
- 2.3.2 A surgical depth of anaesthesia must be maintained during and until the animal has recovered from blockade.
- 2.3.3 An anesthetic log must be maintained. For an example of a suitable type of log visit the Animal Care and Use Website and look on the [Factsheets page](#) under ‘Records.’
- 2.3.4 The use of neuro-muscular blocking agents must be confined to the time period required for experimental purposes as outlined in the approved AUP.
- 2.3.5 The animal should be allowed to recover from the blockade, anaesthetic depth reassessed and adjusted as necessary prior to giving any subsequent doses. **Subsequent doses of neuromuscular blocking agents without recovery are not permitted unless justified in an approved protocol.**
- 2.3.5.1 The change in anaesthetic protocol, if required, must be included in a “Within Year Modification” form.
- 2.3.5.2 A subsequent dose may then be administered.
- 2.3.6 Minimum monitoring rodents
- 2.3.6.1.1 Visual monitoring plus heart rate and O₂ saturation or blood gases or end tidal CO₂.
- 2.3.6.2 Multiple doses or invasive procedures
- 2.3.6.2.1 As above plus blood pressure
- 2.3.7 Minimum monitoring for non-rodents
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2.3.7.1 Single dose, minimally invasive procedure

2.3.7.1.1 Visual monitoring plus heart rate, blood pressure and O₂ saturation or blood gases or end tidal CO₂.

2.3.7.2 Multiple doses or invasive procedures

2.3.7.2.1 Visual monitoring plus heart rate, blood pressure, O₂ saturation and blood gases or end tidal CO₂.

2.3.8 Direct visual monitoring by a trained individual is essential. All results from monitoring equipment must be assessed by a trained individual.

2.3.9 Increases in heart rate and blood pressure (in the absence of experimental influences) may indicate that the animal is not adequately anaesthetized. When such changes are identified an increase in anaesthetic depth is required. However, the absence of these responses **does not** indicate that the animal is adequately anaesthetized, especially in neonatal animals.

2.3.10 Where repeat doses of neuromuscular blockade are used frequently in research protocols monitoring should be enhanced to provide the best overall picture of anaesthetic depth and animal welfare. Additional monitoring could include more parameters than those indicated above, the use of EEG etc. Any monitoring systems used must be well understood by those using them.

2.4 Recovery

2.4.1 In order to assess adequacy of anaesthesia in the conclusion of an experiment, the animal should be allowed to recover from blockade before gas anaesthetics are reduced. Any indication that anaesthetic depth was not appropriate ***must be followed by immediate change to protocol through submission of a 'Within Year Modification.'***

2.4.1.1 The change in anaesthetic protocol, if required, must be included on a "Within Year Modification" form.

2.4.2 The animal may not be returned to its home cage or left unattended until individuals monitoring the animal are certain that the animal is stable.

2.5 Reversal

2.5.1 If reversal agents are used, the animal must be very carefully monitored to ensure that the respiratory depression does not recur.

3.0 SUMMARY

3.1 These are the minimal standards of monitoring that must be followed for animals under neuro-muscular blockade. Additional monitoring procedures (see 2.2.7,) if used, must be indicated in the approved "Animal Use Protocol".

4.0 REVISION HISTORY

Revision	Reason(s) for Revision	Initiated by
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5.0 REFERENCES / ASSOCIATED MATERIALS

5.1 Definitions

₁ MAC intubate (1.3 MAC) – Minimum alveolar concentration of anaesthetic that would inhibit movement and coughing during endotracheal intubation.

₂ MAC BAR (1.5 MAC) – Minimum alveolar concentration of anaesthetic necessary to prevent adrenergic response to skin incision, as measured by concentration of catecholamine in venous blood, increase in heart rate, blood pressure etc.. When different inhaled anaesthetics are compared, the ratio of MAC BAR to MAC intubation of MAC awake is relatively constant.

5.2 MAC for some commonly used species (Intubated and on Isoflurane)

It is important to note that MAC varies considerably with age and body temperature. Unless indicated otherwise these values are for normothermic, intubated adult animals.

- 5.2.1 Rat -1.35% (+/- 0.1%)
- 5.2.2 Mouse -1.24% to 1.4% depending on strain
- 5.2.3 Dog -1.28 +/- 0.06%
- 5.2.4 Cat - 1.63 +/- 0.02%
- 5.2.5 Pig, adult - 1.55%
- 5.2.6 Pig, newborn - 2.47 +/- 0.28%

6.0 ATTACHMENTS

- 6.1 None