

**PROCEDURE FOR: Peripheral Nerve Stimulator / Train of Four Monitoring**

**POLICY:** To be used in conjunction with the ICU policy for Neuromuscular Blocking Agents (NMBA): IV Administration.

1. Patients in the Intensive Care Unit who are receiving neuromuscular blocking agents (NMBAs) will be evaluated by the RN staff using a peripheral nerve stimulator (PNS) and train of four (TOF) at regular intervals.
2. Assessments using the PNS will be completed prior to initiation of NMBA (when possible) to determine a baseline level of stimulation, 10 - 15 minutes after a bolus dose is given and drip is initiated, every 1-2 hours until a satisfactory level of blockade is achieved, and every 4 hours during the continuous infusion.
3. The physician/APRN will determine the daily need for NMBAs and the level of paralysis desired (as reflected by a number of twitches on the TOF).
4. The ulnar nerve in the wrist is the preferred site for testing. The facial or posterior tibial nerve may be used when wounds, edema, invasive lines or other factors interfere with ulnar nerve testing.

**SUPPORTIVE DATA:**

1. The muscle twitch response to a small electrical stimulus delivered by the PNS corresponds to the degree of nerve receptors blocked by NMBAs and assists the clinician in the assessment and titration of medication dosage.
2. Four twitches signifies that 75% or less of the receptors are blocked, three twitches corresponds to approximately 80% blockade, one to two twitches correlate with approximately 85-90% blockade, and zero twitches may indicate that 100% of the receptors are blocked (exceeding the desired level of blockade).

TOF stimulation/correlation of Blocked Nerve Receptors

<u># twitches</u>	<u>Percent blockade (approx.)</u>
0/4	100%
1/4	90%
2/4	85%
3/4	80%
4/4	75% or less

3. TOF results should not be the sole source for decisions regarding medication adjustment. It should be interpreted along with clinical indicators of adequate paralysis (ie. limited observable muscle movement, limited # spontaneous breaths above the ventilator). The patient may demonstrate subtle movement of the extremities with an acceptable TOF response. Assessment of oxygenation, ventilation, neurologic function, tissue perfusion, and other clinical goals must also be considered.

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**EQUIPMENT:** Peripheral Nerve Stimulator (w/lead wires and batteries)  
2 electrode pads  
Alcohol wipes

**PROCEDURE:**

<u>ACTION</u>	<u>POINTS OF EMPHASIS</u>
1. Explain the procedure and purpose to the patient and family.	1. Inform the patient that the PNS may cause a discomfort or tingling.
2. Wash hands.	
3. Prep the monitoring site by cleansing vigorously with an alcohol pad and allow to dry.	
4. Place electrodes on the selected site. (Refer to diagram on page 4.) <u>Ulnar:</u> Place distal electrode at the wrist and second electrode 1-2 cm proximal to the first, along the same line. <u>Facial:</u> Place first electrode on the face at the outer canthus of the eye and second electrode approx. 2 cm below, parallel with the tragus of the ear. <u>Posterior Tibial:</u> Place one electrode approx. 2 cm posterior to the medial malleolus in the foot and second electrode approx. 2 cm above first.	4. The ulnar nerve is the preferred testing site.
5. Attach the lead wires to the electrodes. Use caution to prevent lead wires from coming in contact with external pacemaker catheter/wires.	5a. Negative and positive leads can be placed on either electrode. b. Microshock can pose a risk to a patient with external pacer wires.
6. Turn on the PNS and select a low mA (or numerical energy setting).	6. Some stimulators do not indicate an mA, but have digital or dialed numbers 1-10 to represent a range of mA.
7. Depress the TOF key and observe the muscle twitch at the thumb (ulnar), above the eyebrow (facial), or great toe flexion (posterior tibial).	7. Do not use single twitch, tetany, or double burst settings as these are less accurate and may cause extreme discomfort.

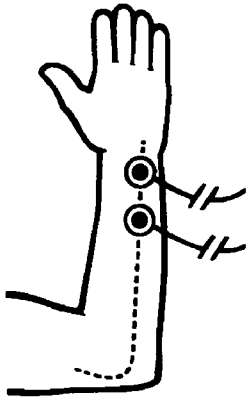
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<u>ACTION</u>	<u>POINTS OF EMPHASIS</u>
8. <u>Determine the supramaximal stimulus (SMS)</u> : (Ideally, this will be done prior to NMBA administration.) Increase the mA dial in increments of 1 and repeat TOF until four vigorous twitches are observed. (Allow 10 seconds before repeating.) Document the mA or number that corresponds to four vigorous twitches. Administer an additional TOF to verify the SMS. This will be the energy setting for successive testing.	8a. If there is no increase in intensity of the twitch when the mA is increased, the SMS is the level at which four vigorous twitches was first observed. If an increase in intensity is observed, raise the mA again until no further increase is observed. The SMS is the number previous to the one that yielded no change.
9. Ten to fifteen minutes after the bolus dose of NMBA is given and the continuous infusion is initiated, retest the TOF.	9. Done to evaluate level of blockade provided.
10. Retest every 1-2 hours until the patient is stable and the desired level of blockade is achieved, and every 4 hours thereafter.	10. Evaluates level of blockade and assists in assuring desired response is achieved without under or overshooting level of NMBA.
11. If three or four twitches occur and this level of blockade is clinically unsatisfactory, notify the physician/APRN, as an increase in NMBA may be warranted.	11. Three or four twitches would signify that $\leq 80\%$ of receptors are blocked.
12. If <u>zero twitches</u> are observed, increase the mA setting one level and repeat the test. If still no twitches are seen, follow these troubleshooting steps: a. Retest another nerve b. Change electrodes c. Check lead connections and PNS for mechanical failure or low battery d. Increase the stimulating current e. If there are no explanations for a zero response, check the infusion for rate, dose, and concentration. f. <u>If still zero response, notify the physician/APRN. A decrease in the infusion rate is likely warranted.</u>	12a. Conditions that can interfere with twitch response include: ▪ poor electrode placement ▪ weak battery ▪ edema or thick skin ▪ electrolyte abnormalities  b. Excessive neuromuscular blockade produces absence of twitch response.

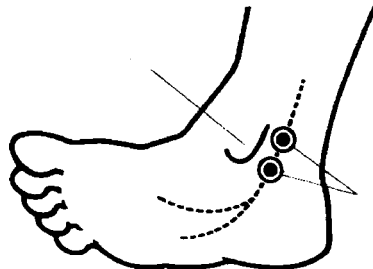
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**DOCUMENTATION:** Document train of four response as TOF x/4 @ xx  
(x = number of twitches, xx = energy level)

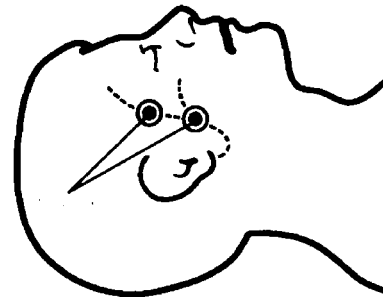
**Site options for electrode placement:**



Ulnar



Posterior Tibial



Facial

Procedure adapted from AACN Procedure Manual for Critical Care, 4<sup>th</sup> edition, 2001.

**Related protocol:** Neuromuscular Blocking Agents (NMBA): IV  
Administration, ICU Unit Practice Manual

**APPROVAL:** ICU Standards Committee  
Critical Care Advisory Committee  
Nursing Standards Committee

**EFFECTIVE DATE:** 5/05

**REVISION DATE:**

**REVIEW DATE:** 2/06