POLICY

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Title:	Use of NPI-200 ® Pupillometer	Effective Date:	{ Publication Date }
Approver(s):	{ Actual Approvers > All Users > Name & Title }		
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POLICY STATEMENT:

The purpose of this policy is to define the use of the NeurOptics®, NPi® -200 pupillometer for automated assessment of pupil size and reaction in the pediatric intensive care unit (PICU).

BACKGROUND:

The assessment of pupillary size and reaction to light stimulus is an integral and standard part of the neurological exam. Asymmetry in the pupillary size, termed anisocoria or abnormal reactivity may indicate changes in a patient's neurologic condition, for example, pupil reaction may be impaired by direct compression of the oculomotor nerve and adjacent vascular and brain structures in states of brain herniation associated with elevated intracranial pressure. It is important to detect and prevent cerebral herniation as this may lead to increased neurologic morbidity and even death. Therefore, the pupil exam is an important component of neurologic monitoring in all patients but particularly in patients with brain mass effect or cerebral edema. This includes but is not limited to patients with traumatic brain injury, stroke central nervous system (CNS) infection or inflammation, intracerebral hemorrhage and acute hydrocephalus. A change in pupil size or reaction may prompt additional evaluation that can result in life-saving medical or surgical therapies.

In recent years, development of quantitative automated pupillometry has helped to overcome some of the subjectivity and human error that may accompany the manual observer 'pen or 'flash-light' pupillary exam. The NPi -200 pupillometer is a simple, hand-held device that uses a standard infrared light source to measure accurate, reliable and objective measurements of pupil size and reactivity which requires no more time than a manual measurement.

DEFINITIONS:

I: NPi-200 Pupillometer: A hand-held portable optical scanner infrared device which takes quantitative pupillary measurements capturing 90 images per second over 3 seconds to assess pupil size and constriction response.

II: Neurological pupil index (NPi): An algorithm developed by the NPi-200 pupillometer's manufacturer, NeurOptics to remove subjectivity from evaluation of the pupillary response. This algorithm uses pupil size, latency to constriction, constriction velocity and dilation velocity compared against a normative model of pupil reaction to light and grades the NPi on a scale of 0 to 4.9.

Measured Value*	Assessment
3.0 – 4.9	Normal/"Brisk"
< 3.0	Abnormal/"Sluggish"
0	Non-Reactive, Immeasurable, or Atypical Response

* A NPi value of < 3.0 or a difference of ≥ 0.7 between eyes is considered abnormal

III: NPi-200 SmartGuard™: A plastic attachment for the NPi-200 pupillometer that contains smart card technology. This has the capability to store up to 168-paired pupillary measurements. SmartGuards are for single-patient use only.

POLICY:

I: Patients who are deemed appropriate candidates for automated pupillometry measurements should have an order for "pupillometry" placed in Epic by a provider with a prescribed frequency.

II: Patients who would not be appropriate candidates for automated pupillometry exam include patients with orbital injury, soft tissue edema around the orbit or with open lesion of the orbit. Patients with coloboma, aniridia, or congenital cataracts should be excluded as these pathologies may alter the pupillary exam.

III: Baseline pupillometry measurements should be obtained upon admission to the PICU after order placement in patients with acute intracranial pathology or if they are deemed to be at risk of developing neurological decline. In addition, if at any point during the PICU stay after admission a medical provider or nurse become suspicious for a new or developing pathology that could benefit from the use of pupillometry, the procedure should be ordered.
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IV: The use of the pupillometer may be considered for patients of any age with neurological injury/disorder or those at risk for neurologic decline. This may include, but is not limited to patients with the following conditions:

a. Traumatic brain injury
b. Intracranial hemorrhage
c. Acute arterial or venous stroke
d. Selected post-operative neurosurgical patients
e. Acute hydrocephalus
f. Post-cardiac arrest
g. Patients receiving ECMO
h. Any patient with an invasive intracranial pressure monitor in place
i. Any patient at risk for raised intracranial pressure
j. Any clinical scenario in which the neurological exam is limited due to patient status (i.e. patients who are heavily sedated/paralyzed or obtunded)

V: When using the NPi-200 pupillometer device reasons to notify a provider include new findings of the following:

- A difference in measured SIZE between the two pupils of > 1mm when size was previously equal
- An NPi value of < 3 in either eye
- A difference in NPi of ≥ 0.7 or more between eyes

*Note: Once a provider has been informed of an abnormal value, for example a NPi value of 2.0, subsequent communication between the nurse and provider should include any changes to the frequency of assessments and further abnormal values to be notified for.

Additional reasons to report abnormal values are a decline in the NPi value of > 1.0 from the patient's baseline (a new change), this should be repeated within 30 minutes. If repeat values remain a > 1.0 decline difference, a provider should be notified for evaluation. Although variation in the NPi value may be observed, a value > 3 may be considered normal. Therefore, the trend of values is important when using the pupillometer.

VI: If patient is unable to cooperate with the NPi-200 pupillometer exam, a traditional pupillary exam may be performed using a flashlight in a dim room.

PROCEDURE:

I: The frequency of the automated pupillary exam will depend on the patient's clinical status but at a minimum should occur every 4 hours. * Important: Manual pupil assessment measurement may still need be performed in between automated pupillometer measurement, for example, if

the pupil exam is to be done hourly and the pupillometer is scheduled for every 2 hours. The frequency will be ordered in Epic, with a default of "every two hours and PRN." This may be adjusted as more or less frequent at the provider's discretion. Nursing staff may perform additional exams, if they feel they are indicated based on clinical impression. If providers do not order pupillometry but nursing feels that the device will provide valuable information during their assessments, the nurse should ask the provider to place an order. Manual pupil exams can be performed at nursing discretion simultaneously when making automated NPi-200 pupil assessments.

II: When not in use the NPi-200 pupillometer will remain ON when seated in the charging station and the battery icon will indicate charge status. To remove the NPi-200 pupillometer from the charging base, lift from the handle straight up.

III: When not in the charging station the device will go into sleep mode after 5 minutes and power down after 30 minutes. In sleep mode, to turn ON touch the screen or button, if powered down press and hold the power button.

IV: For a new patient encounter, open a new SmartGuard. Gently squeeze the SmartGuard™ side tabs to position onto the NPi-200. There will be an audible click when the SmartGuard™ is properly positioned.

VI: Upon connection, there will be a prompt to input a patient ID. Press "Manual Entry." Using the touchscreen, enter the patient's FIN as "1111" to avoid storage of patient identifying information. Once this information is entered, select "Enter." The pupillometer should now display "Ready to scan."

VII: To match the SmartGuard to the patient, attach a patient identification sticker from the medical record on the clear plastic portion of the SmartGuard. *Note: each SmartGuard is for a single-use only and not be shared between patients. The hand-held NPi-200 device may be docked at a central working station and shared between patients as long as the SmartGuard remains in the room with the patient and is removed prior to central charging/docking placement.

VIII: Position the NPi-200 with SmartGuard at a right angle to the patient's axis of vision minimizing any tilting of the device by keeping it as parallel to the patient's face, as possible.

IX: Press and hold either the RIGHT or LEFT button until the eye is centered on the touchscreen and the display shows a green circle around the pupil. Once the green circle appears, release the button, and hold the NPi-200 in place for approximately three seconds until the result screen is displayed. Once the screen reads "analyzed" it no longer needs to be held over the patient's eye.

X: Repeat the scan procedure for the patient's other eye to complete the bilateral pupil exam.

XI: When the bilateral pupil exam is complete, the NPi-200 measurement results will be displayed in yellow for the left eye and in green for the right eye.

XII: Using the touchscreen or keypad, select page 1 (1/2) or 2 (2/2) to display the results of the pupil measurement parameters and pupillary light reflex waveform. Video playback of the reading may also be viewed by selecting the video icon from the results screen.

Image: Display screens 1 and 2.

XIII: After both values are obtained, the pupilsize and NPi for each eye should be documented in the Epic flow-sheet that corresponds with automated pupillometry (see below). Note: this will be a separate section, underneath manual pupil assesment. Once the pupillometer is ordered the pupillometer charting row will be visible in the patient's chart. This row can also be manually added to each patient's flow sheet. NPi should be reported to one tenth of a decimal point and

pupillary size should be reported to one-hundredth of a centimeter. Pupillary size should still be documented in the standard 'Eye' pupillary exam portion of the flow-sheet, but should be rounded to the nearest whole number. The subjective pupillary response of "normal/brisk," "abnormal/sluggish," or non-reactive/absent should also be documented in the standard 'Eye' fields. The NPi value can be used to assess the responsiveness category (see Definitions II).

NEUROLOGICAL						
Anterior Fontanel						
LOC						
Behavior						
Eyes						
Left Pupil Size				3 mm		
Left Pupil Reaction				Brisk		
Right Pupil Size						
Right Pupil Reaction						
Pupillometer						
Left Pupil Size				3.12		
Left Pupil NPI				4.1		
Right Pupil Size						
Right Pupil NPI						
GCS						
Eye Opening						
Verbal Response						
Motor Response						
GCS Score						
GCS Intubation Status						

XIV: Abnormal values should be reported immediately to the provider (see Section VI under "POLICY").

XV: To display the patient's pupil size and NPi trend parameteres, use either the keypad or the touchscreen to select the Chart icon from the main screen of the NPi-200. Select the DOWN arrow on the keypad to view a trend display of the patient's NPi and Size measurements. To trend additional parameters, select "Trending Variables" from the Settings menu, and choose the desired parameters to trend.

XVI: Special considerations: If the measurement was affected by a tracking problem (e.g., blinks) then measurement results are all displayed in red font on the results screen and NPi is reported as "Rescan". In this case, the measurement results are not valid and should not be relied upon and the measurement should be repeated. In case of a non-responsive pupil, before reporting the results on the LCD screen, the measurement is automatically repeated for confirmation. The operator is simply asked to wait a few more seconds before removing the device. If the operator believes a second confirmatory measurement is not necessary, then press the **RIGHT** or **LEFT** button to skip

XVII: Remove the SmartGuard™ headrest. Keep the SmartGuard in the patient's individual locked bedside supply cart for further use. The headrests are for single patient use and may be used on that specific patient for as long as he/she is in the hospital.

XVIII: Once the patient is ready for discharge or transferred out of the PICU, permanently disable and delete patient data stored on the SmartGuard by attaching the it to the NPi-200 device and turning the device on. The user should subsequently enter the Settings menu, press "Disable SG" and follow the prompts. Remove the attached patient identification sticker from the device. After the patient identification label is removed AND the SmartGuard has been disabled it can be discarded in a regular wastebasket.

XIX: Place the pupillometer gently but securely in the charger when not in use. The touchscreen will display a blue battery icon indicating it is charging. The battery icon will turn green when fully charged. If the NPi-200 is not in the charging station, to conserve battery life the pupillometer will:

A. Go into sleep mode after 5 minutes. Touch the screen to turn on.
B. Power down after 15 minutes. Press and hold the up arrow to turn back on.

XX: The NPi-200 devices should be cleaned by members of the ICU staff between patient measurements, using the Super Sani-Cloth disinfectant wipes (purple top). Ensure that the device is completely dry before plugging the device into the charging station. Do not allow any other cleaning products to contact the gold connector blades located on the bottom of the handle. Do not use an oversaturated cloth to clean the device or to allow excess cleaner to accumulate on the device. Do not immerse the device or charging station in liquid or attempt to sterilize.

SOURCES:

Related Policies:
None

Joint Commission Manual:
None

Medicare Conditions of Participation:
None

State or Federal Statute(s) or Regulation(s):
None

References:

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