NPI, pupilometer Guidance for Critical Care

In critical care we measure several clinical observations in our patients. Of particular interest for those with reduced consciousness and neurological conditions are their pupillary response to light.

Traditionally this has been how they respond to light and size using millimetres. Whilst this is useful there is a degree of operator variability, and some more subtle changes may not always be observed.

In Critical Care to reduce this variation we use an objective measuring device called Pupillometer that measures the neurological pupil index (NPI) which is described below.

What is Pupillary Light Reflex (PLR)?

When light is shone onto the eyes, pupils constrict in response to the light stimulus. This is known as the pupillary light reflex.

A pupillometer uses several different components to quantify the PLR [1].

The components are:

1. Baseline pupil size
2. The time taken for pupils to start constricting from baseline size (latency)
3. How fast pupils constrict from baseline after exposure to a light stimulus (constriction velocity)
4. The smallest size of the pupil after constriction (minimum pupil size)
5. Percentage change in pupil size from baseline pupil size to minimum pupil size (percentage change)
6. How fast pupils dilate after constriction (dilation velocity)
7. Symmetry between right and left pupil

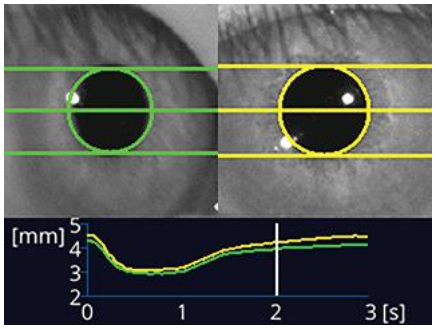


Figure 1: Video Replay of Pupillary Light Reflex using a Pupillometer [2].

Figure 2: Sample Results Screen in Pupillometer 1 [2].

What is a pupillometer?

A pupillometer is an automated handheld device that measures pupil reactivity [3]. The device's built-in camera first assesses the baseline pupil size, followed by a 3-second flash of light to measure the different variables that quantify the pupillary light reflex (PLR) [4]. The device then uses these measured variables to calculate the neurological pupil index (NPi) [4].

Figure 3: NPi-300 Pupillometer [2].

Figure 4: Measuring NPi with Pupillometer [3]

What is neurological pupil index (NPI)?

Neurological Pupil Index is a value derived from an algorithm calculated using the quantifiable variables (mentioned above) that comprise the pupillary light reflex, measured by a pupillometer . NPI gives a value that indicates a patient's pupil size and reactivity.

Figure 5: Sample Result Screen 2 [2].

Why do we use NPI?

NPI provides an objective and quantifiable measurement of pupillary size and reactivity, removing the subjectivity of assessing pupillary size and reaction using a pen torch, which is user dependent.

NPI also provides a quantitative trend in pupillary response, allowing healthcare professionals to track changes in a patient's pupillary reactivity.

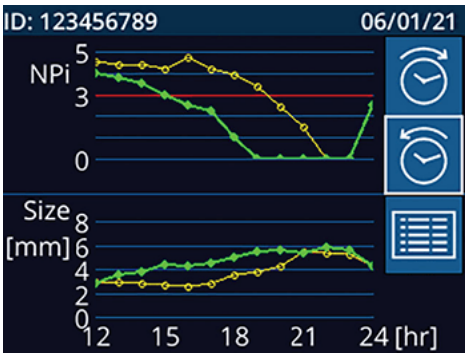


Figure 6: Pupillometer Establishes a Baseline and Trend for Changes [2].

Why do we monitor NPI?

NPI supports clinicians in detecting significant intracranial events and allows clinicians to promptly identify any changes in patients that might suggest neurological deterioration, such as hydrocephalus, brain herniation, increased intracranial pressure (ICP) and cerebral oedema, allowing them to make prompt interventions when this may not have been observed with the traditional measurement of pupil reactivity.

What do the numbers mean?

NPI is graded on a scale of 0 to 5.

A score of 0 indicates that the pupils are non-reactive.

A score below 3 indicates an abnormal pupillary response.

A score equal to or above 3 indicates that the pupillary reaction is within the normal range.

The higher the number, the brisker the pupillary response.

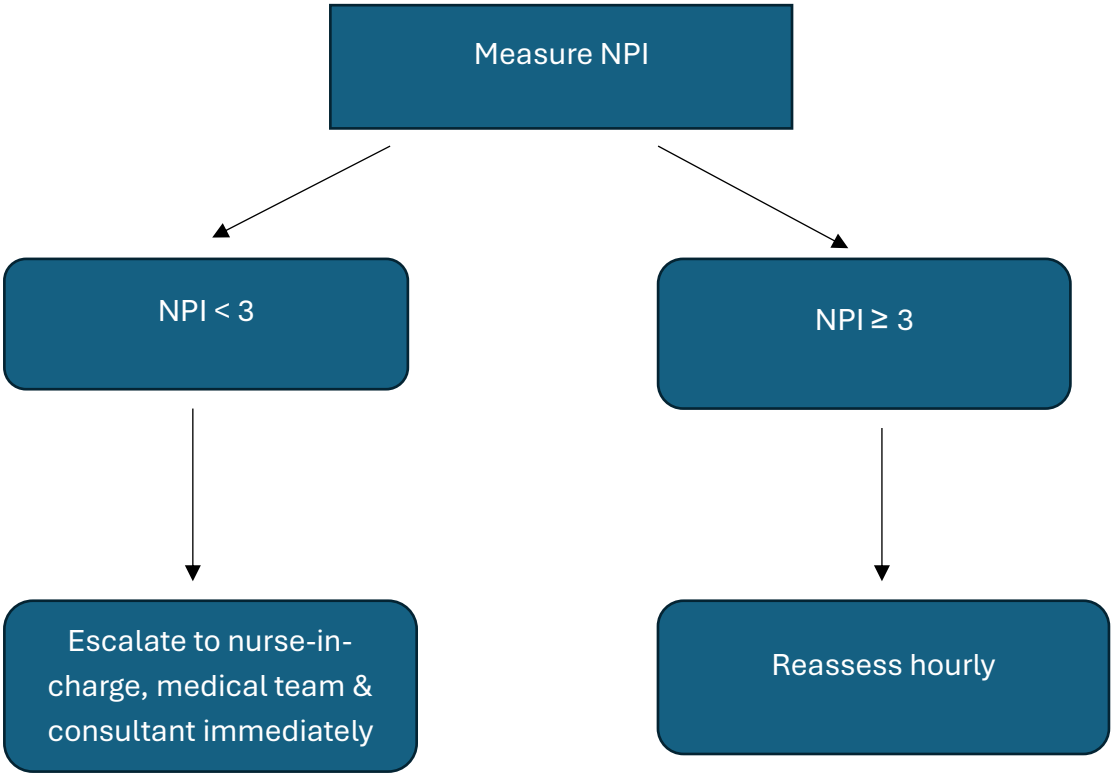
Measured Value*	Assessment
3.0 – 4.9	Normal
< 3.0	Abnormal
0	Non-Reactive, Immeasurable, or Atypical Response

**A difference in NPi between Right and Left pupils of ≥ 0.7 may also be considered an abnormal pupil reading*
**Per the Neurological Pupil index (NPi) algorithm*

Figure 8: The Neurological Pupil Index (NPi) and Pupil Reactivity Assessment Scale [2].

When to escalate?

An NPI score of less than 3 should be immediately escalated to the nurse-in-charge, medical team and or the consultant-in-charge.


Measure NPI
NPI < 3
NPI ≥ 3
Escalate to nurse-in-charge, medical team & consultant immediately
Reassess hourly

References

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