Neurological pupil index

The Neurological Pupil index, or NPi, is an algorithm developed by NeurOptics, Inc., that removes subjectivity from the pupillary evaluation. A patient's pupil measurement (including variables such as size, latency, constriction velocity, dilation velocity, etc.) is obtained using a pupillometer, and the measurement is compared against a normative model of pupil reaction to light and automatically graded by the NPi on a scale of 0 to 5. Pupil reactivity is express numerically so that changes in both pupil size and reactivity can be trended over time, just like other vital signs.

The numeric scale of the NPi allows for a more rigorous interpretation and classification of the pupil response than subjective assessment.

Clinicians routinely check the pupils of critically injured and ill patients to monitor neurological status. However, manual pupil measurements (performed using a penlight or ophthalmoscope) have been shown to be subjective, inaccurate, and not repeatable or consistent.

Automated assessment of the pupillary light reflex has emerged as an objective means of measuring pupillary reactivity across a range of neurological diseases, including stroke, traumatic brain injury and edema, tumoral herniation syndromes, and sports or war injuries. Automated pupillometers are used to assess an array of objective pupillary variables including size, constriction velocity, latency, and dilation velocity, which are normalized and standardized to compute an indexed score such as the Neurological Pupil index (NPi).

Abnormal neurological pupil index and hemorrhagic conversion are significantly associated with malignant cerebral edema (MCE) in patients following mechanical thrombectomy (MT). Further investigation is warranted to better define an association between NPi and patient outcomes in this patient population [1)].

Case series

Case series of 3 patients who had poor baseline clinical neurological examinations. Because it would be more difficult to detect acute neurological deterioration, automated infrared pupillometry and the Neurological Pupil Index (NPi) were used in addition to the clinical neurological examination. NPi values < 3.0 prompted further imaging. In each case, abnormal NPi values prompted emergent imaging that confirmed acute cerebral edema and resulted in a change in management and treatment plan. The automated infrared pupillometry is a noninvasive monitor that can provide additional objective data in patients with a poor baseline neurological examination in whom it may otherwise be difficult to detect neurological deterioration [2)].

El Ahmadieh et al. conducted a prospective pilot study at a level-1 trauma center between November 2019 and February 2020. AIP readings of consecutive patients seen in the emergency department with blunt TBI and abnormal imaging findings on computed tomography were recorded by the assessing neurosurgery resident. The relationship between NPI and surgical intervention was studied.

Thirty-six patients were enrolled, 9 of whom received an intervention. NPI was dichotomized into normal (≥3) versus abnormal (<3) and was predictive of intervention (Fisher exact test; $P < 0.0001$). Six of the 9 patients had a Glasgow Coma Scale (GCS) score ≤8 and imaging signs of increased intracranial pressure (ICP) and underwent craniectomy (n = 4) or ICP monitor placement (n = 2) and had an abnormal NPI. Three patients underwent ICP monitor placement for GCS score ≤8 in accordance with TBI guidelines despite minimal imaging findings and had a normal NPI. The GCS score of these patients improved within 24 hours, requiring ICP monitor removal. NPI was normal in all patients who did not require intervention.

AIP could be useful in triaging comatose patients after blunt TBI. An NPI ≥3 may be reassuring in patients with no signs of mass effect or increased ICP [3].

References

[1]
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