NPi®-300
PUPILLOMETER

NPi® is the ***only*** accurate and objective measurement of pupil reactivity in many common critical care scenarios, including in the presence of opioids, neuromuscular blocking agents (NMBA's) and sedatives.*

NEUROPTICS®

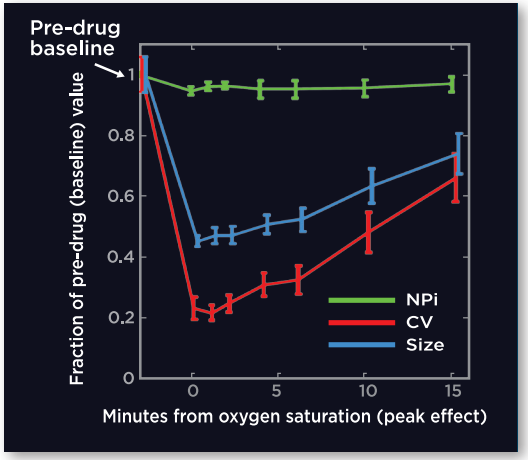

Figure 1**

Linear associations corrected for repeated measures between percentage of PLR (upper panel) and PD (lower panel) variations, and patients' blood concentrations of analgesics and sedatives (nanograms per milliliter [ng/mL]). The black line represents the regression line.

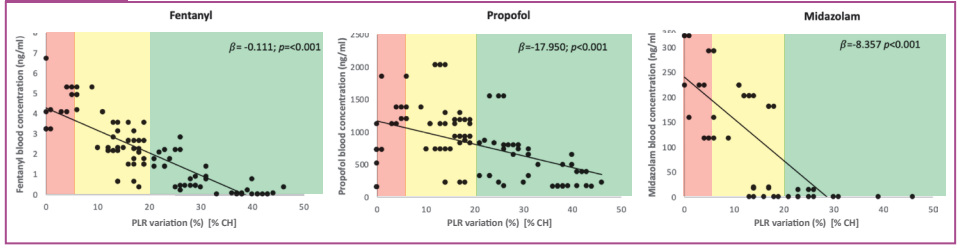

Figure 2**

Measurement of singular pupillary measurement parameters, including percent change of pupil size (% CH) and constriction velocity (CV), are subject to **significant influence by common ICU medications** and may lead to inaccurate conclusion of neurological changes.**

Fig. 1: Rollins MD, Feiner JR, Lee JM, Shah S, Larson M: Pupillary effects of high-dose opioid quantified with infrared pupillometry. Anesthesiology: The Journal of the American Society of Anesthesiologists, 121(5): 1037-1044, 2014.

Fig. 2: Martineau-Lessard C, Arbour C, Germélus NE, Williamson D, De Beaumont L, Bernard F: Pupil Light Reflex for the Assessment of Analgesia in Critically Ill Sedated Patients With Traumatic Brain Injury: A Preliminary Study. Journal of Neuroscience Nursing, 54(1): 6-12, 2021.

Published Medication Findings

Pupillometry and NPi® (The Neurological Pupil index™)

** The following excerpts refer to the medication effects on pupillary measurements, as found by the authors in the referenced publications:*

Authors	Clinical Study	Finding	Medication
Jolkovsky, E et al.	Impact of acute intoxication on quantitative pupillometry assessment in the emergency department (JACEP Open, September 2022)	**...NPi remains unaffected by clinical intoxication and can potentially be used for ED patient evaluation without risk of confounding by key intoxicants of abuse, such as opioids...**	amphetamines, barbiturates, benzodiazepines, cocaine metabolites, ethanol, methadone, opiates (including oxycodone and fentanyl), phencyclidine, and tetrahydrocannabinol (THC)
Kim, T et al.	Neurological Pupil Index as an Indicator of Neurological Worsening in Large Hemispheric Strokes (Neurocritical Care, Feb 24, 2020)	...**NPi values were not significantly influenced by sedative drugs, consistent with previous studies**...	midazolam, remifentanil, dexmedetomidine, propofol
Miroz, JP et al.	Neurological Pupil index for Early Prognostication After Venoarterial Extracorporeal Membrane Oxygenation (CHEST, Feb 7, 2020)	...**No significant correlation was found between NPi values and the average daily cumulative dose of sedatives**...	midazolam, propofol, fentanyl
Oddo, M et al.	Quantitative versus standard pupillary light reflex for early prognostication in comatose cardiac arrest patients: an international prospective multicenter double-blinded study (Intensive Care Med, Nov 26, 2018)	...**In this setting, since it is not altered by sedatives/analgesics, NPi may confer a significant advantage over sPLR and provide accurate prognostic information, particularly in those patients with sedation or delayed awakening**...	sedatives, analgesics
Larson, M et al.	Portable Infrared Pupillometry: A Review (Anesthesia-Analgesia, June 2015)	...**PLR is generated by smooth muscle and is unaffected by neuromuscular blocking drugs**...	NMBA
McKay, R et al.	Detection of opioid effect with pupillometry (Autonomic Neuroscience: Basic & Clinical, Aug 2021)	...**Because our cases were titrated into the range of dangerous opioid toxicity and we observed no change in NPi, we conclude NPi changes cannot be attributed to opioid therapy**...	remifentanil
Achamallah, N et al.	Pupillary Light Reflex is Not Abolished by Epinephrine and Atropine Given During Advanced Cardiac Life Support in Patients Who Achieve Return of Spontaneous Circulation (J of Intensive Care Medicine, April 2021)	**...Epinephrine and atropine do not abolish the PLR in patients who achieve ROSC after in-hospital cardiac arrest. Lack of pupillary response in the post-arrest patient should not be attributed to these drugs...**	epinephrine, atropine

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