"There's More Than Meets the Eye“
Focusing on the Future of Automated Pupillometry: A Case Study

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Abstract

The use of automated pupillometry in neurocritical care units has increased in recent years (Olson & Fishel, 2016). The purpose of the automated pupillometer is to provide more objective and reliable data regarding pupillary reactivity (Couret et al., 2016). Neurocritical care units are implementing these devices to aid in earlier detection of neurological deterioration. Specifically, changes in pupillary reactivity can indicate neurological decline such as ischemic events and increased intracranial pressure (Zafar & Suarez, 2014). This poster will provide a case study demonstrating how pupillometer trends served as an early indicator of a middle cerebral artery ischemic stroke.

Objectives

1. Learners will be able to describe the function of automated pupillometry.
2. Learners will be able to recognize significant changes in pupillometer data.
3. Learners will be able to apply pupillometer data and anticipate early interventions.

Introduction

The purpose of the automated pupillometer is to remove the subjectivity in assessment of the pupils when performing a neurological assessment.

Pupillometry Variables:

•**NPI** - “The Neurological Pupil Index (NPI), is an algorithm developed to provide an objective and quantifiable way for clinicians to rate the pupillary light reflex and is derived from various calculated parameters (e.g., constriction velocity, dilation velocity, and latency) graded on a scale of zero to five” (Al-Mufti, 2016).

•**Constriction Velocity (CV) –** “The amount of the constriction divided by the duration of the constriction; this results in an average velocity.” (Chen et al., 2011)

•**MAX/MIN – “**The minimum pupil size is the pupil size at the peak of the constriction. Maximum pupil size is the initial resting pupil size, and is defined by the mean pupil size during the latent period.” (Chen et al., 2011)

•**Percent Change (PC) –** “Constriction percentage is defined as the maximum size minus the minimum size divided by the maximum size.” (Chen et al., 2011)

Background and Assessments

Patient Status

Demographic data: 31 year old female

Medical History: hypertension, obesity, coronary artery disease, postpartum cardiomyopathy, chronic kidney disease stage III, CHF, asthma, pulmonary hypertension, and LV thrombus

Current diagnosis and treatment: The patient presented to the hospital with left-sided deficits and dysarthria caused by a complete occlusion of the right common carotid artery (CCA) and right internal carotid artery (ICA). TPA was administered, however the symptoms did not improve. A thrombectomy of the right ICA and right CCA was performed and both vessels were successfully recannulized. The patient remained on the neurocritical care unit and demonstrated some neurological improvements.

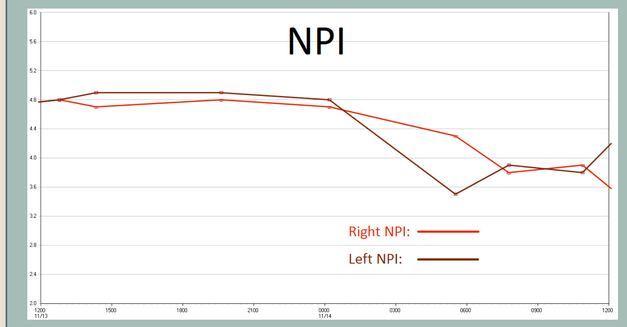
Nursing Assessment

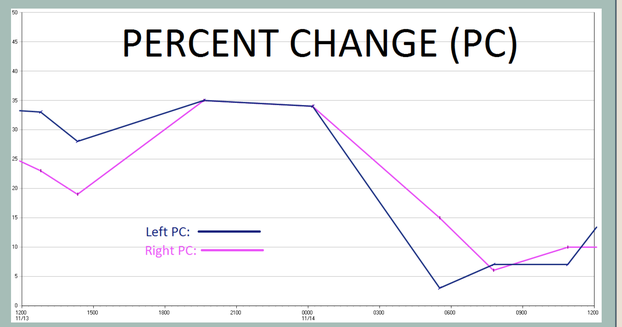
Two weeks after admission, the patient demonstrated a sudden neurological decline (becoming obtunded and flaccid on all extremities). Pupillometer data was obtained before and after this event per the unit’s standard pupillometry protocol.

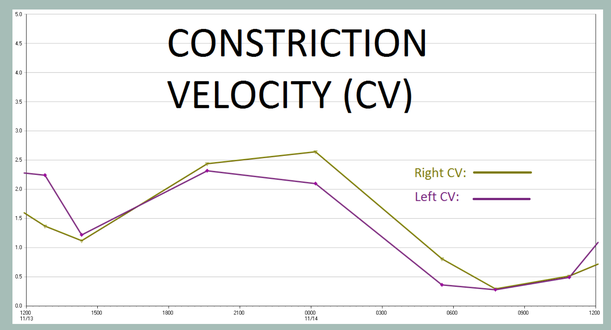
Care Plan

A non-contrast head CT was performed, which did not reveal any acute changes. The neurological changes were attributed to seizures and/or overuse of narcotics. An MRI performed two days later revealed a new embolic infarct to the entire left anterior communicating artery (ACOM) and left middle communicating artery (MCA) regions and brainstem compression from a new occlusion to the left carotid artery.

Below, pupillometer metrics collected before and after the second ischemic event have been plotted. The graphs below demonstrate how pupillometer data trends served as an indicator of acute ischemia before changes in neurological assessment were detected.







Conclusions

Recommendations for changes in the current care plan:

•Amend the current protocol to trigger more frequent pupillometry assessments when the following changes in pupillometer data are detected:

- NPI value of less than 3
- Decrease in NPI by 0.7 or more from the previous value
- NPI values unequal between eyes by more than 0.7
- Percent change <10%
- Constriction velocity <0.8
- Pupil max size difference greater than 1mm

•If the above changes are detected, a provider should be notified in order to obtain diagnostic imaging.

•If pupillometry data continues to decline, and/or the patient’s assessment does not improve, more definitive testing such as a head CTA or MRI should be considered.

References

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There are no relevant conflicts of interest to disclose.