

## Associations Between Pupillary Reactivity and Intracranial Pressure in ICH Patients

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### Introduction

Elevated intracranial pressure (ICP), usually monitored by invasive ICP-measurements, is associated with mortality in intracerebral hemorrhage (ICH). The non-invasive evaluation of pupillary function using automated pupillometry is increasingly used in critical-care settings. The association of various pupillary parameters assessed by automated pupillometry with ICP is unestablished, specifically the sensitivity and specificity during ICP-elevation and the performance of sympathetic versus parasympathetic parameters.

### Methods

We enrolled 8 ICH patients admitted to our neurocritical-care unit who received invasive ICP-measurement by an external-ventricular-drain (EVD). We monitored parameters of pupillary reactivity [i.e. light-reflex latency (Lat; s), constriction and re-dilation velocities (CV, DV; mm/s), and percentage change of apertures (per-change; %)] using a portable pupilometer (NeuroOptics®) as well as corresponding ICP values up to every 30 minutes for the duration of hospital stay. Receiver Operating Characteristic (ROC) analysis was performed to investigate associations between changes in pupillary reactivity and elevated ICP. Sensitivity and specificity of sympathetic and parasympathetic pupillary parameters were analyzed to evaluate associations between pupillary reactivity and ICP-elevation (ICP $\geq$ 20mmHg).

### Results

In 4 patients (3 women, mean age 71.5 $\pm$ 4.2 years), without ICP-elevation and no midline shift upon neuroimaging, 170 assessments were compared to 72 assessments in 4 patients (2 women, 52.0 $\pm$ 17.2 years) during ICP-levels >20mmHg and corresponding midline shift. ROC-analyses revealed a significant negative association of all assessed pupillary parameters with ICP-elevation. Best discriminative thresholds for ICP-elevation were: CV20 mmHg were found for a combination of the parasympathetic parameters CV

### Conclusions

**Our data suggest an association between non-invasively detected changes in pupillary reactivity and elevated ICP.** Parameters of parasympathetic pupillary modulation seem most reliable to indicate ICP-elevation.