

Validation of quantitative pupillometry, for neuroprognostication in patients resuscitated from cardiac arrest

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Background/Introduction

Quantitative pupillometry is being recommended as part of a multimodal approach to the bedside armamentarium, for obtaining prognostic information in post-cardiac arrest management. However, recent guidelines are still based on limited evidence, and lack of knowledge about the variability of pupillary measurements may impair clinical usefulness.

Purpose: To assess precision and accuracy of quantitative pupillometry to validate its clinical use in neuroprognostication.

Methods: We conducted a prospective blinded validation study, based on repeated patient assessments in a cardiac intensive care unit. Each assessment was made by two trained staff nurses and consisted of one manual and one quantitative pupillometry each, performed on the same patient within 2 minutes. Data from each measurement was stored in the pupillometers head guard, blinded to the other observer.

To investigate inter-observer variation (precision), the repeated measures of pupillary size (both quantitative and manual individually) were compared, and for accuracy by comparing quantitative with manual assessment. Further we assessed the variation in neurological pupil index (NPI), a scalar value (between 0 and 5) calculated from an algorithm comprising several measured pupillary variables.

Bland-Altman analysis was performed with mean difference between the two methods of measurement and 95% limits of agreement (LoA), and intraclass correlation coefficient (ICC) assessed for absolute agreement between the methods.

Results: A total of 56 measurements (left and right eye) were included in this study. Fifty-seven percent were male, with a mean age of 65 years (SD 14). Out of hospital cardiac arrest constituted 57 %, and 65 % of the measurements were made, while patients were sedated. The 30-day mortality of this population was 50 %.

Bland-Altman analysis showed mean inter-observer differences equal to -0.14 mm (LoA: 0.71, -1.00) for pupillary size measured by manual pupillometry, and 0.03 mm (LoA: 0.36, -0.31) for pupillary size measured by quantitative pupillometry. Mean pupillary size by automated pupillometry and manual assessment, was 2.28 mm (SD 0.84) and 2.22 mm (SD 0.84) respectively, with significant correlation between manual and quantitative pupillometry ($R = 0.84$, $p < 0.001$; ICC 0.83). Mean inter-observer differences for NPI measured by quantitative pupillometry was -0.02 (LoA: 0.40, -0.43).

Conclusion(s)

Quantitative pupillometry has twice the precision in assessment of pupillary size compared with manual assessment. Both pupillary size and NPI may, however, still have a challenging reproducibility.

Abstract Figure.

