The use and uptake of pupillometers in the Intensive Care Unit

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ARTICLE INFORMATION

ABSTRACT

Background: Traumatic brain injury (TBI) is a significant public health issue. Assessing pupil reactivity is a crucial aspect of its management and the pupillometer has been shown to be a more objective tool compared to the standard penlight. Its use, however, is not widespread.
Objective: To investigate the paucity in uptake, we examined the frequency of use of pupillometers (NeurOptics® NPi-100™) amongst Intensive Care Unit (ICU) doctors and nurses, evaluated its user-friendliness and explored barriers to its use.
Design: An online cross-sectional survey.
Methods: Surveys were distributed five months after the introduction of pupillometers (in May 2015) to ICU doctors and nurses working in a quaternary referral centre providing state services for trauma. The survey included sections on: questions on demographics and experience, methods of conventional pupillary assessment in patients with TBI, experience of using the pupillometer, and questions on barriers to its use. Responses were collated as discrete variables and summarised using counts and proportions. Comparisons among proportions were undertaken using the chi-squared test and reported with 95% confidence intervals.
Results: A total of 79 responses were recorded, predominantly 94.9% (n = 75) from nursing staff. A total of 50 (63.3%) responders were using the pupillometers, with a mean frequency-of-use rating of 4.67 out of 10 and a mean user-friendliness rating of 6.28 out of 10. There was no association between frequency of use and user-friendliness (p = 0.36). The main identified barriers to its use included a lack of education with regards to its use, a perceived lack of clinical significance, a lack of standardisation of documenting findings, and difficulties with access to disposable patient shields (Smartguards).
Conclusions: There was good adoption of the technology in the early phases of ICU implementation with user-friendliness rated favourably. In this paper we identify barriers to use and discuss possible solutions to increase clinical utility.

1. Introduction

Traumatic brain (TBI) is a significant public health issue and socioeconomic burden worldwide; it is a major cause of death, and lifelong disability is common even with survival.[1] Its incidence is estimated to be up to 700 per 100,000 head of population.[2] The pupillary response is widely known to be crucial to triaging, prognosticating and guiding subsequent management of patients with brain injuries,[3] and hence it is vital that its assessment is as accurate and reproducible as possible.[4,5]

Recent studies have shown that there is limited interrater reliability for subjective scoring of pupillary assessments via the traditional method of using a handheld light source.[6–10] In contrast, the automated pupillometer has proved to be an accurate and objective tool in pupillary assessment compared to subjective manual examination.[11–14] Despite its obvious advantages, the pupillometer has yet to gain widespread use in Intensive Care Units (ICU) in Australia.

To our knowledge, most studies to date have only looked at the accuracy and reliability of automated pupillometry, but there are no studies that have examined the frequency of pupillometer use in

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Fig. 1. The NeurOptics NPi®-100 Pupillometer is shown on the left. The Smartguard® is shown on the right, a single-patient-use device which acts as an interface between the patient and the Pupillometer.

pupillary assessments and barriers to its use. Larson et al. acknowledged that despite its clinical utility in anaesthesia and critical care, the pupillometer has not gained widespread use.[15] It is therefore important to explore why there is paucity in uptake despite the obvious advantages.

The purpose of our study was to examine the frequency of pupillometer use amongst ICU doctors and nurses, evaluate its user-friendliness and explore barriers to its use.

2. Materials and methods

2.1. Study design and population

The study was a web-based Google™ survey of ICU nurses and doctors of varying experience working at Alfred Hospital, Melbourne, Australia (approximately 450 staff in total). The Alfred Hospital is a quaternary referral centre and is one of two hospitals providing state services for adult trauma. The ICU comprises 45 cubicle units and admits approximately 3000 patients per year.

During the introduction of the pupillometers (NeurOptics® NPi-100™ Pupillometer) in May 2015, emails were sent to all ICU staff to inform them of its arrival. Group education sessions were also organized for all Assistant Nurse Managers and Clinical Educators. Since then, informal one on one bedside education has been the main form of ongoing education. Ethics approval for this project and the distribution of surveys was obtained from the Alfred Hospital Research and Ethics Committee.

2.2. Survey

The ICU nurse unit manager promoted and distributed the surveys via email to all ICU staff over a period of five months from October 2015 to February 2016. Reminder emails were sent out on two further separate occasions in November 2015 and January 2016. Participants were able to add free text at the end of the survey pertaining to general comments and suggestions regarding pupillometer use.

The web-based survey consisted of four main sections.

1. Demographics and experience
   a. Position in ICU
   b. Number of years of experience
2. Details of conventional pupillary assessment methodology in patients with traumatic brain injury
   a. Frequency of pupillary assessment per shift
   b. Method of documentation of findings including descriptive terms and location of documentation
   c. Discrepancy between findings with colleagues
3. Experience of using the pupillometer
   a. Frequency of use (rated on an ordinal scale with 1 = no use, 10 = use all the time)
   b. User-friendliness (rated on an ordinal scale with 1 = not user-friendly at all, 10 = extremely user-friendly)
   c. Consistency (discrepancy between two consecutive measurements and between users)
   d. Preference over conventional methods
4. Barriers to more frequent use of the pupillometer

The survey can be found in Supplementary Appendix 1.

2.3. Pupillometer

The NeurOptics® NPi-100™ Pupillometer is a hand-held portable infrared device which is used with a disposable patient