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How accurate is the AVPU scale in detecting neurological impairment when used by general ward nurses? An evaluation study using simulation and a questionnaire

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Summary
Objectives: to evaluate accuracy, sensitivity, specificity and inter-rater agreement of AVPU (Alert, Voice, Pain, Unresponsive) when used by non-specialist nursing staff assessing consciousness, and to investigate users' views.
Methods: Video-recorded simulations of assessments of consciousness were developed and verified by an expert panel. Participants scored simulations using AVPU and completed questionnaires eliciting views on the scale. AVPU scores were compared with functional levels agreed by the panel.
Setting: A large urban teaching hospital.
Results: Fifty-one participants scored 255 simulations. Overall accuracy was 82.4% (95% CI = 77.7—87.1%), sensitivity 0.94 (95% CI = 0.90—0.98), specificity 0.74 (95% CI = 0.66—0.82) and inter-rater agreement (un-weighted kappa) 0.782. Accuracy was low for simulations depicting an orientated patient whose eyes open to speech (49% correct) and a confused patient with spontaneous eye opening (61.5% correct). Sensitivity and agreement for levels corresponding to ''Alert'' and ''Voice'' were 0.81 (95% CI = 0.69—0.93) and kappa = 0.506. Participants expressed uncertainty about aspects of AVPU's use.
Conclusions: AVPU had low rates of accuracy, sensitivity and agreement in distinguishing between ''Alert'' and ''Voice'', and low specificity overall, suggesting it may be unsuitable for early warning scoring. Participants expressed doubts about the use of AVPU.
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Implications for Clinical Practice

- The AVPU has poor sensitivity to moderate neurological impairment and poor specificity overall; there are therefore concerns about the appropriateness of its use to monitor conscious levels as part of an Early Warning Score.
- Nurses working on acute general wards are uncertain how to use AVPU to assess consciousness.
- There is an urgent need to clarify, modify or replace the AVPU as an element of early warning systems for acutely ill patients.

Introduction

Changes in conscious levels are recognised widely as a sign of serious deterioration in acutely ill hospital patients, associated with increased risks of ICU admission and death (Buist et al., 2004; Duckitt et al., 2007; Goldhill and McNarry, 2004; Goldhill et al., 2005; Kellett and Deane, 2005; Rylance et al., 2009; Subbe et al., 2001). Track-and-trigger systems are widely used to monitor patients' key physiological signs, including conscious level, and are now mandatory in British hospitals (NHS Litigation Authority, 2012, p. 364; Smith et al., 2013). Most UK systems are variants on the Early Warning Score (EWS) (Morgan et al., 1997) which included the AVPU scale as its measure of consciousness, rather than the more established Glasgow Coma Scale (GCS) (Teasdale and Jennett, 1974). The AVPU scale (patient is: Alert, responding to Voice, responding to Pain, Unresponsive) originated in the Advanced Trauma Life Support protocol (American College of Surgeons Committee on Trauma, 1989) and has been described as ''simple'' (Kelly et al., 2004; Mackay et al., 2000; McNarry and Goldhill, 2004), ''rapid'' (Kelly et al., 2004; Mackay et al., 2000) and ''easy'' (Jevon, 2008), desirable attributes of a tool used by non-specialist or unqualified staff on general wards for frequently repeated observations.

However, evidence to support AVPU's use as part of track-and-trigger systems is poor. AVPU's sensitivity and specificity to neurological impairment have never been tested. Gill et al. (2007) found low rates of inter-rater agreement (percentage agreement 57%, un-weighted kappa = 0.41) when emergency room physicians used the scale. Research on AVPU has hitherto been conducted with participants who have the experience and training in neurological assessment which the scale is thought not to require — ambulance technicians (Mackay et al., 2000), neurosurgical nurses (McNarry and Goldhill, 2004), poisons unit nurses (Kelly et al., 2004) and emergency room physicians (Gill et al., 2007) — rather than with staff who rely on AVPU to observe patients on general acute wards. Only McNarry and Goldhill (2004) considered the scale as a repeated routine ward observation rather than a one-off assessment. The assumption that the non-specialist staff who rely on AVPU will find it easy to use (Jevon, 2008) is not based on evidence.

Moreover, there is no consensus as to how patients should be examined using the scale. The ATLS manuals from which AVPU was drawn neither defined the term ''Alert'' nor specified the responses the assessor should seek from a patient. Instructions and algorithms in subsequent publications offer conflicting advice on key aspects. Does a patient have to be orientated to be scored as Alert as some suggest (Kelly et al., 2004; Mackay et al., 2000), or not (Jevon, 2008; Mistovich et al., 2008; Peate and McGrory, 2009)? If a patient whose eyes open to speech is scored as responding to voice, even if he is fully orientated and follows commands (Jevon, 2008; Kelly et al., 2004; Mackay et al., 2000; Mistovich et al., 2008; Peate and McGrory, 2009), does AVPU clearly distinguish intact from impaired patients? Revisions of the AVPU scale have appeared, adding ''confusion'' (Goldhill et al., 2005; Heaps et al., 2005; Pittard, 2003; Thompson et al., 2009; von Lilienfeld-Toal et al., 2007), ''new confusion'' (Odell et al., 2002; Robb and Seddon, 2010) or ''agitation'' (Heaps et al., 2005; Robb and Seddon, 2010; Smith et al., 2006) as elements distinct from response to voice but producing the same EWS score. These papers do not describe how confusion or agitation should be assessed nor establish the validity of their adapted versions of AVPU as measures of consciousness.

There is, therefore, little evidence to support AVPU's widespread use for the early detection of potentially critical deterioration in hospital patients. It is important to evaluate AVPU for its fitness for purpose in track-and-trigger systems intended to prevent avoidable deterioration and death.

Methods

This research project began with two questions: whether AVPU allows non-specialist staff to distinguish between patients with significant neurological impairments and those without, and whether the views and experiences of those staff reflect the assumption that AVPU is suited for their use.

This study used video-recorded simulations to evaluate the accuracy, sensitivity, specificity and inter-rater agreement of AVPU to impaired consciousness when used by nurses working in acute adult general wards. A panel of clinical experts was used to derive a standard for comparison. A Likert-type questionnaire was used to elicit participants' views of the scale.

Simulations

Video-recorded simulations permit multiple participants to assess identical clinical scenarios, allowing calculations of accuracy, sensitivity, specificity and inter-rater agreement against a defined standard. Simulations do not require the consent of patient participants, an important consideration given that patients with acutely impaired consciousness cannot consent, while procedures to seek and document the carer consultation required by UK law (Great Britain, 2005) might signal to nurse participants the researcher's view that a patient lacks capacity.

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