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LITERATURE REVIEW

Practical use of the Glasgow Coma Scale; a comprehensive narrative review of GCS methodology

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Summary
Objective: Narrative review of Glasgow Coma Scale (GCS) methodology.
Design: Narrative review of published papers describing methodological aspects of the GCS, from Premedline, Medline, EMBASE, CINAHL and Ovid Nursing databases from 1950 to May 2012.
Results: Examination of 18,851 references limited to descriptions of GCS development, pathophysiological correlations, examination techniques, complications or clinician agreement gave a final set of 33, which were summarised in this review.
Conclusion: The GCS was designed for the objective measurement of level of consciousness, assessment of trend, and to facilitate accurate and valid communication between clinicians. Concerns have been raised about the potential for misleading levels of precision engendered by the use of the GCS, and the use of simpler scales suggested. This review discusses the GCS and conditions affecting calculation of domain and summary scores, and recommends a method of implementation and interpretation.

Introduction

Impairment of consciousness is one of the most consistent features of head injury. The Glasgow Coma Scale (GCS) was described by Teasdale and Jennett in 1974,[1] based on a theoretical model of level of consciousness. It was introduced as a simple tool, initially in the research setting, as a method of describing states of impairment within the consciousness continuum.[1]

The GCS is utilised in many clinical specialities and settings not limited to the original patient group, raising issues of validity, diagnostic discrimination and prognostic power. Importantly, this widespread use has not been accompanied by instruction for clinicians in the appropriate methodologies needed to consistently and reproducibly use this tool. Many studies document variability and lack of agreement between the GCS measured by different clinicians and in

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What is known?

- The GCS was designed for assessment of consciousness in head injured patients in the 1970s, and has become ubiquitous since, now being put to many uses for which it was not originally designed.
- There have been concerns expressed regarding complexity, spurious precision, lack of agreement between individuals and groups of clinicians, and therefore validity of the scale.
- It has been suggested that subsets of GCS or alternative simpler scores may be useful.

What this paper adds?

- This paper comprehensively reviews published work relating to the derivation and use of the GCS, together with the identified advantages, disadvantages and flaws of the tool.
- It proposes that if subscores or adaptations of the GCS replace it for consciousness assessment, there is still a need for a standardised methodology with which to perform the assessment, the lack of which potentially lies at the heart of the flaws in GCS scoring agreement between clinicians.
- This paper discusses the intent of the original authors and their proposed methodology for use, then identifies and describes a standardised approach which should be utilised by all clinicians in the use of the GCS.

different clinical settings, making accurate and useful measurements of trend over time unlikely.[2–4] Assessment of consciousness has therefore developed in a variable way, leading to inconsistency in the application of stimuli, evaluation of responses, and summarising of component scores.

The purpose of this review is to provide an overview of the Glasgow Coma Scale in both its adult and paediatric forms, discuss conditions affecting the calculation of both domain and summary scores, explore innovation and alternative scores to GCS in the measurement of consciousness, and to recommend a standardised method of examination.

Materials and methods

A literature search was undertaken in Medline, Premedline, EMBASE, Ovid Nursing Database and CINAHL databases from 1950 to May 2012. Medical Subject Headings (MeSH) terms were Neurologic$ Examination, Coma, Glasgow Coma Scale, Brain Injuries, Consciousness, Unconsciousness, Consciousness Disorders, together with text words — level of consciousness, Glasgow coma score, assessment, measurement and methodology, and author names Teasdale G and Jennett B. These were limited by the terms methods, methodology, practice guidelines, clinical practice, development, technique, neurologic examination, physical examination, examination, examination technique, complications, clinician agreement, agreement, and pathophysiologic$ correlation, human and English language. A complementary search was made in all databases, using the above search terms, but adding children OR child OR paediatric OR pediatric terms. Hand searching of references was performed.

Results

18,851 references were found; an online review of abstracts and a hand-search gave 66 relevant references, limited to a final set of 33 describing GCS development, pathophysiological correlations, examination techniques, complications, and clinician agreement, as well as comparisons with simplified or component scores derived from the GCS, and references discussing the implementation and outcomes of specific paediatric derived versions of the GCS.

Early studies, including the original work by Teasdale and Jennett, were descriptions of case series of various sizes[1,6–12] from which much of the methodology of the GCS was drawn, including a descriptive study on paediatric head injury outcomes.[6] Early references also included letters from the original authors, elucidating aspects of the scale.[1,2,14] One early clinical trial was performed by Teasdale to examine Interobserver variability.[13]

A number of analyses of trauma registry data, and secondary analyses of data collected for other trials comprised a substantial proportion of relevant studies,[15–22] with clinical trials, including comparisons of Interobserver variability in cohort studies and later investigations of novel or abbreviated scores compared to GCS, being seen since 2005.[13,23–27]

A number of narrative reviews were utilised, mainly originating from nursing literature and concerned with methodology and implementation of the GCS.[5,28–31] Although sometimes unsupported by well-designed trial data they provided valuable insight into accepted practice among frequent users of the scale. Three systematic reviews were found, two summarising research into the GCS overall and one summarising research into associations with outcome in mild head injury patients alone.[3,4,32] One guideline was utilised,[33] describing alterations to the verbal domain in paediatric patients, due to its ubiquity and authority in the training of clinicians for the assessment of acute childhood illness.

Fig. 1 illustrates the processes of literature searching and study assessment, and Tables 1 and 2 detail included references and relevant study design.

Discussion

The National Institutes of Health, Public Health Service and the US Department of Health and Human Services funded two international studies in parallel,[27] one studying the prognosis of medical coma and the other studying coma in patients with severe head injury. As a result of this innovation, the Coma Index, and then the Glasgow Coma Scale, were developed in an attempt to standardise and quantify measurement of levels of consciousness.[27]

The original authors stated ''In the acute stage, changes in conscious level provide the best indication of the development of complications such as intracranial haematoma, whilst the depth of coma and its duration indicate the degree