Neurological Sciences (2024) 45:2899–2901
https://doi.org/10.1007/s10072-024-07432-9

HISTORY OF NEUROLOGY

The Glasgow Coma Scale: 50-year anniversary

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Received: 18 January 2024 / Accepted: 26 February 2024 / Published online: 4 March 2024

Abstract
In 1974, Sir Graham Teasdale and Bryan Jennett wrote the "Assessment of coma and impaired consciousness, A practical scale," which has become one of the most influential papers in the history of traumatic brain injury, with more than 10,000 citations as of January 2024. Today, it is one of the most widely used tools in emergency departments, providing a reliable general overview of the patient's consciousness status.

Keywords Glasgow Coma Scale · Traumatic brain injury · History · Consciousness

Introduction

In 1974, Sir Graham Teasdale and Bryan Jennett wrote the "Assessment of coma and impaired consciousness, A practical scale," which has become one of the most influential papers in the history of traumatic brain injury, with more than 10,000 citations as of January 2024 [1]. This tool, invented 50 years ago, initially as a 14-point scale and later modified into a 15-point scale, rapidly became one of the most widely used tools in emergency departments. The intention behind its design was to create a user-friendly tool applicable in both general and specialized units, replacing previously ambiguous and inconsistent assessment methods.

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Development of the Glasgow Coma Scale

Bryan Jennett, a graduate of Liverpool, was a remarkable neurosurgeon with prior experience in the research of tentorial herniation and cerebral circulation. In 1967, he secured a position in neurosurgery at the University of Glasgow and swiftly rose to prominence as one of the foremost academic neurosurgeons in the world. Sir Graham Teasdale, a graduate of Newcastle, gained experience in head injury outcomes while working with the neurologist Henry George Miller and the neurosurgeon George Frederick Rowbotham, author of the book *Acute injuries of the head*, first published in 1942. Opting to pursue training at the Glasgow unit, Teasdale was drawn to its stellar reputation for providing exceptional clinical exposure and research opportunities, aligned with his interests. The Glasgow unit emerged as the second largest in the country, serving a population of around 3 million people [2].

In the early 1960s, there was a lack of an objective tool to measure the degree of impairment in patients with consciousness disturbances. Terms such as lethargy, semicoma, malingering, hysteria, obnubilation, stupor, and obtundation, mainly originated from war memorandums, served as attempts to measure consciousness disturbances. However, their lack of standardization led to confusion and misuse within the medical community. This lack of standardization raised concerns, especially when communicating between different shifts or institutions. Moreover, estimating the degree of severity and the prognosis of the patient was crucial for determining the therapeutic approach, given the high burden of traumatic injuries and the shortage of

neurosurgeons at the time, due to the centralization of neurosurgical units in the UK.

In an effort to standardize the evaluation of consciousness, neurosurgeon Ayub K. Ommaya proposed a 5-point system for measuring consciousness impairment in 1965. However, this system failed to gain widespread acceptance within the medical community, criticized for being too simple. Similarly, in 1968, neurosurgeon William F. Bouzarth proposed his own system for assessing head injury patients. His proposal consisted of a systematic and profound evaluation of the patient. However, it was impractical in emergency departments and in establishing prognoses.

The collaboration between Teasdale and Jennett in crafting a new coma scale commenced in 1971, marking the beginning of an enduring partnership. After reviewing various systems for describing consciousness impairment, they observed consistencies: motor response, verbal performance, and eye-opening remained the most evaluated functions. In 1974, the article entitled "Assessment of coma and impaired consciousness, A practical scale" was published in *The Lancet*, incorporating these three functions [1, 2].

With a series of studies involving both physicians and nurses, the authors compared the previous vague terms with the new proposed scale using a disagreement rate. They found that both physicians and nurses used the previous vague terms inconsistently, while the new proposed scale showed great reliability. Although this scale did not initially receive overall acceptance at first, it gradually gained recognition due to its viability. In 1976, the scale was modified to address the distinction between "normal" and abnormal flexor response, eventually becoming the widely recognized Glasgow Coma Scale that we use today [2].

It was not until 1978 that the GCS gained its final and greatest impulse with the publication of the first edition of the Advanced Trauma Life Support (ATLS) guidelines, which recommended its use. The decision to sum the three categories of the GCS into a total score ranging from 3 to 15 was made in 1979. This approach allowed for the depiction of continuous relationships between the total score and overall mortality, as well as independent recovery, a pattern subsequently replicated and refined in numerous later studies [2].

Through the years, many authors have proposed adaptations of the GCS, especially in pediatric populations, where verbal response and command understanding may not be adequately evaluated. Nevertheless, they have not been entirely embraced, and their routine use is uncommon. Other consciousness assessment scales have been proposed to replace the use of the GCS, such as the alert/verbal/painful/unresponsive scale (AVPU), the modified GCS (MGCS), and the simplified motor scale (SMS). However, when compared with the GCS, these scales exhibit inferior validity [3]. In contrast, for intubated patients, some scales, such as the Full Outline of UnResponsiveness (FOUR) scale, have performed better than the GCS.

Despite its great viability, the GCS is not perfect. One notable drawback is its omission of brainstem reflexes evaluation, a deficiency later assessed in the Glasgow-Liège Scale. However, despite this enhancement, this scale did not gain widespread adoption. Another concern is the weighting of the GCS components, with motor response exerting the greatest influence on the final score. Therefore, assessing the GCS components individually is fundamental to ensure accurate evaluation. Timing of assessment should also be considered. Initially, it was recommended to conduct assessments after 6 h, to allow for diagnosis and management of other potential causes that could impact consciousness, like alcohol and intoxications. However, as advancements were made in initial patient stabilization, this timing is no longer considered. In addition to timing, appropriate pain stimulation should also be considered. Furthermore, the usage of other complementary severity scores is essential for accurately determining patient outcomes.

Conclusion

It has been 50 years since the publication of the GCS, and it is important to acknowledge that, despite its imperfections, its simplicity, objectivity, and ease of reproducibility have contributed to making it one of the most used scales globally, assisting numerous patients over the years.

Author contribution All authors contributed equally to this work.

Declarations

Ethical approval Not applicable.

Informed consent Not applicable.

Conflict of interest The authors declare no competing interests.

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