The total Glasgow Coma Score (tGCS) is not a useful clinical tool in the assessment of patients presenting with traumatic injuries

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Clinical Scenario

An advanced care paramedic crew is dispatched code 1A to a 35-year-old male with an altered level of consciousness, abnormal breathing, and skin changes. On arrival you rendezvous with a critical care paramedic and find a tGCS 12 (E3, V4, M5) patient with tachypnoea, weak and thready peripheral pulses and a depressed skull fracture located on the right parietal bone. The critical care paramedic is sceptical of your tGCS calculation, and reassesses the patient, with conflicting findings. After a short discussion, the team decides that the score will not influence management or triage during this case, as such, an exact answer is inconsequential. The crew then completes their assessment, treating and packaging him, before transporting under lights and sirens to a nearby Major Trauma Centre.

PICO (Population – Intervention – Comparison – Outcome) Question

In patients with injuries of traumatic aetiology, can prehospital clinicians (emergency medical technicians, paramedics, prehospital physicians) accurately apply tGCS during patient assessment?

Search Strategy

A search of the literature was performed using MEDLINE Ovid, EMBASE, CINAHL Complete and the Cochrane Central Register of Controlled Trials (CENTRAL) from Week 1 January 2015 to Week 1 September 2020. Reference lists of identified articles were also perused to locate articles not initially found in the electronic database search. The MeSH headings and keywords were used individually and combined, and are outlined in Table 1. Search results were limited to journal articles written in English that enrolled human participants.

Articles discussing the inter-rater reliability and/or accuracy of prehospital clinicians utilising tGCS prehospitally or in the emergency department for patients with traumatic injuries were included. Case reports, editorials, reviews, papers not applicable to the PICO question and studies conducted in inappropriate medical settings were excluded.

Table 1

MeSH headings and keywords formulated using a modified PICO approach

Population	Intervention	Outcome
Pre-hospital	GCS	Accura*
Prehospital	Glasgow Coma Score	Inter-rater
Out of hospital	Glasgow Coma Scale	Reliab*
Paramedic*	tGCS	Reproduc*
EMS		Valid*
Emergency department		Disagree*
Trauma*		Practic*
Injur*		Consisten*

Study Results and Analysis

The database and manual search yielded 229 results; 15 publications met inclusion; 10 articles were subsequently excluded; 5 were suitable for discussion in the critical appraisal. The screening process and article exclusion per stage is presented in Figure 1; Table 2 provides a summary and detailed analysis of the included articles.

Figure 1

Summary of article inclusion/exclusion per screening stage

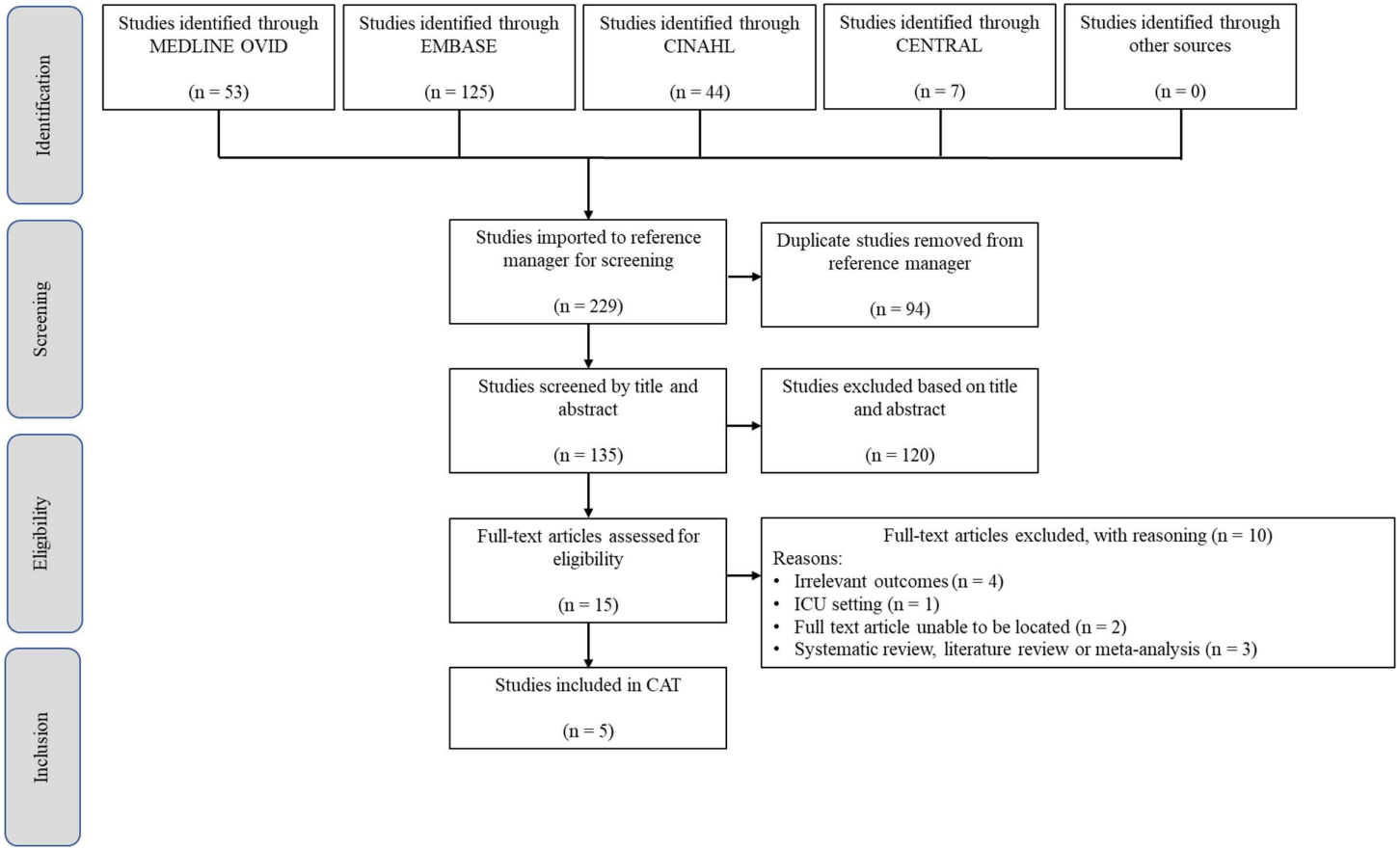

Table 2

Detailed summary and analysis of included articles

Reference	Study Population and Design	Outcomes	Results	Strengths	Limitations	OCEBM LOE and Journal IF
(Bledsoe et al., 2015)	Prospective multi-centre study of 217 prehospital and in-hospital clinicians. Participants were shown 10 video scenarios and asked to score tGCS 2,084 individual tGCS observations were made	To determine accuracy and reliability of tGCS scoring between emergency care providers	Overall tGCS accuracy for all clinicians was 33.1% (95% CI, 30.2-36.0) Average prehospital clinician tGCS accuracy was 34.25%. Paramedics and AEMTs were more accurate than EMTs and CCPs tGCS scores are highly inaccurate, with poor inter-rater reliability between healthcare providers. Simpler, scoring systems should be formulated and validated for application to the emergency prehospital environment	Prospective; multi-centre; Large, significant sample size; contemporary literature Video scenarios were reviewed independently by two neurologists with perfect inter-rater agreement (k = 1) All methodological strategies were outlined and justified Statistical analysis and primary outcomes are homologous with pre-existing research on the topic	Unrandomized and unblinded Clinician bias could be present as the study was self-opt in/out The two neurologists may have incorrectly assessed tGCS Video scenarios may inaccurately represent trauma patients encountered by prehospital clinicians Poor generalisability to trauma practice Low impact journal	IIb 1.010

Table 2 *(continued)*

Reference	Study Population and Design	Outcomes	Results	Strengths	Limitations	OCEBM LOE and Journal IF
(Chan et al., 2018)	RCT of 25 Hong Kong ACMOs using simulated videos. Clinicians were randomly assigned to an aided group and a non-aided group and assessed on their ability to calculate each GCS component	To determine if scoring assessment aids can improve tGCS accuracy in HEMS clinicians	No significant difference in accuracy between the experimental and control group for tGCS assessment was found (60% versus 60%) tGCS accuracy was 60% for each cohort Number of years of experience did not improve accuracy Scoring errors may not be due to recall limitation, but due to insufficient understanding of the scale and how to correctly elicit responses	RCT; contemporary literature Experimental and control groups were analogous Furthermore, 78% of eligible clinicians agreed to participate, indicating strong internal validity Simulated videos represent reality better than written scenarios used by pre-existing research	Single centre; single provider; small sample size Clinician bias could be present as the study was self-opt in/out 1 specialist emergency medicine physician was used to determine "correct" tGCS score Assessment was conducted in the classroom setting, reducing generalisability to real trauma patients Low impact journal	Ib 0.542

Table 2 *(continued)*

Reference	Study Population and Design	Outcomes	Results	Strengths	Limitations	OCEBM LOE and Journal IF
(DiBrito et al., 2018)	Retrospective review of trauma registry data from a single centre between 2000-2015 5,306 patients ≤15yo transported to the ED with trauma team activation met inclusion criteria	To determine the change in tGCS between PH-GCS and ED-GCS (delta-tGCS) in paediatric trauma patients	PH-GCS assessments differ significantly from ED-GCS, especially in patients aged 0–3 years Increased age and increased PH-tGCS is associated with a lower relative risk of nonzero delta-tGCS (age: RR 0.65 95% CI 0.56–0.74; prehospital GCS: RR 0.73 95% CI 0.72–0.74). I.e., increased patient age and increased tGCS score resulted in improved accuracy	Large, significant sample size; contemporary literature Rigorous inclusion and exclusion criteria described and justified Compares prehospital clinicians with in-hospital clinicians Good generalisability for paediatric trauma patients Study utilised Poisson and multiple linear regression models for statistical analysis Moderately impactful journal	Single centre; retrospective; unblinded; unrandomized Poorly generalisable to the adult trauma population Study cannot discriminate between neurological changes and clinician disagreement Prehospital clinician education levels were not provided	IIb 1.919

Table 2 *(continued)*

Reference	Study Population and Design	Outcomes	Results	Strengths	Limitations	OCEBM LOE and Journal IF
(Drews et al., 2019)	Retrospective analysis of electronic health record data from a level-1 paediatric trauma centre between 1994-2016 1,711 patients aged ≤18yo with a diagnosis of TBI were included	To determine inter-rater reliability of tGCS between prehospital and in-hospital personnel	tGCS scores between prehospital and trauma centre providers frequently differ in paediatrics with TBI's (k = 0.61, 95% CI 0.57-0.64) 13% of tGCS scores differed by >3 points between prehospital and in-hospital clinicians Prehospital and in-hospital agreement was especially low for patients <3yo (k = 0.51 versus 0.63, P = 0.02)	Large, representative sample size; contemporary literature Rigorous inclusion and exclusion criteria described Good generalisability to paediatric trauma patients Moderately impactful journal	Retrospective; single centre; unblinded; unrandomized The database used does not specify if paediatric or adult GCS was used Poorly generalisable to the adult trauma population Possibility for overlap as the cohort was dichotomised, presuming that patients <3yo would be assessed using paediatric GCS Study cannot discriminate between neurological changes and clinician disagreement	IIb 2.187

Table 2 *(continued)*

Reference	Study Population and Design	Outcomes	Results	Strengths	Limitations	OCEBM LOE and Journal IF
(Feldman et al., 2015)	RCT of 178 EMTs and paramedics Nine patient scenarios were formulated, with participants randomly assigned to determine tGCS in one out of nine scenarios	To assess prehospital providers tGCS scoring accuracy with and without an assessment aid	Overall, 41% of participants correctly identified tGCS. The control group (no aid) was correct 25% of the time compared to the experimental group, 57% 69% of scores fell within one point of the correct tGCS Clinicians were equally as likely to over or underestimate tGCS The incorrectly calculated score was frequently deviated enough to change the assigned mild/moderate/severe obtundation category	RCT; large and statistically significant sample size; strong internal validity; contemporary literature Methodologies were clearly outlined and mirrored previous research tGCS scores were calculated and validated by multiple specialist physicians Moderately impactful journal	Single centre; unblinded Video scenarios may inaccurately represent trauma patients encountered by prehospital clinicians Poor generalisability to real world trauma assessment	Ib 5.799

Abbreviations: ACMO; Air crewman officer; AEMT, advanced emergency medical technician; CCP, critical care paramedic; CI, confidence interval; ED, emergency department; ED-GCS, emergency department-Glasgow Coma Score; EMT, emergency medical technician; GCS, Glasgow Coma Score; HEMS, helicopter emergency medical service; IF, impact factor; K, Cohen's kappa; OCEBM LOE, Oxford Centre for Evidence-Based Medicine Level of Evidence; PH-GCS, prehospital-Glasgow Coma Score; RCT, randomised controlled trial; RR, relative risk; TBI, traumatic brain injury; tGCS, total-Glasgow Coma Score; YO, years old

Discussion

Rationale

The tGCS is a widely applied assessment tool in the emergency prehospital setting, and is used to direct triage decisions and management (Bledsoe et al., 2015). Unfortunately, there remain significant limitations during measurement, resulting in over and under triage, delays to critical interventions, increased costs, and inefficient resource utilisation (Drews et al., 2019). Despite being the predominant neurological scale, its usefulness in trauma assessment cannot exceed its reproducibility.

Comments and Considerations for Practice

The available literature suggests that prehospital clinician tGCS accuracy and inter-rater reliability is poor, commonly differs between prehospital and in-hospital measurement, and is especially challenging in the paediatric population. Frequently, deviation from the correct score was sufficient to alter the assigned level of obtundation (mild/moderate/severe), potentiating changes in triage and management.

Despite these findings, insufficient contemporary evidence exists concerning prehospital clinician tGCS accuracy in traumatic patients. In particular, there is a paucity of generalisable randomised controlled trials (RCT) examining inter-rater reliability and clinician accuracy. To establish the true accuracy rate, additional prospective trials should be conducted, incorporating an external observer on-scene with responding crews, enabling tGCS validation in real time. Furthermore, RCT's exploring alternative neurological scales and the use of measurement aids should be undertaken, with the aim of improving accuracy and assessment techniques.

Clinical Bottom Line

There is insufficient evidence to support a deviation in clinical practice away from tGCS. However, prehospital clinicians must remain cognizant of its limitations and decrease its influence during the evaluation and management of prehospital trauma patients.

References

Bledsoe, B. E., Casey, M. J., Feldman, J., Johnson, L., Diel, S., Forred, W., & Gorman, C. (2015). Glasgow Coma Scale scoring is often inaccurate. *Prehospital & Disaster Medicine, 30*(1), 46-53. https://doi.org/https://dx.doi.org/10.1017/S1049023X14001289

Chan, S. Y., Tsang, C. H., Woo, W. W. K., Yeung, C. Y., Leung, L. Y., Lo, R. S. L., Hung, K. K. C., & Graham, C. A. (2018). Does an assessment aid improve Glasgow Coma Scale scoring by helicopter rescuers in Hong Kong: A randomised controlled trial. *Australasian Emergency Care, 21*(3), 105-110. https://doi.org/https://dx.doi.org/10.1016/j.auec.2018.06.001

DiBrito, S. R., Cerullo, M., Goldstein, S. D., Ziegfeld, S., Stewart, D., & Nasr, I. W. (2018). Reliability of Glasgow Coma Score in pediatric trauma patients. *Journal of Pediatric Surgery, 53*(9), 1789-1794. https://doi.org/https://dx.doi.org/10.1016/j.jpedsurg.2017.12.027

Drews, J. D., Shi, J., Papandria, D., Wheeler, K. K., Sribnick, E. A., & Thakkar, R. K. (2019). Prehospital versus trauma center Glasgow Coma Scale in pediatric traumatic brain injury patients. *Journal of Surgical Research, 241*, 112-118. https://doi.org/https://dx.doi.org/10.1016/j.jss.2019.03.038

Feldman, A., Hart, K. W., Lindsell, C. J., & McMullan, J. T. (2015). Randomized controlled trial of a scoring aid to improve Glasgow Coma Scale scoring by emergency medical services providers. *Annals of Emergency Medicine, 65*(3), 325-329. https://doi.org/https://dx.doi.org/10.1016/j.annemergmed.2014.07.454