

SERIAL GLASGOW COMA SCALE ASSESSMENT DURING THE EMERGENCY MANAGEMENT OF MODERATE TRAUMATIC BRAIN INJURY IN PATIENTS WITH DIFFERENT COMORBIDITY PROFILES: A CASE SERIES

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Abstract

Background: Moderate traumatic brain injury (mTBI) is a major cause of morbidity and mortality that requires prompt emergency management to prevent secondary brain injury. Although serial Glasgow Coma Scale (GCS) assessment is routinely used for neurological monitoring, evidence describing its role in evaluating early management outcomes among patients with different comorbidity profiles remains limited. This case series aimed to describe the usefulness of serial GCS assessment as an indicator of immediate emergency management outcomes in patients with moderate traumatic brain injury and different comorbidity profiles.

Investigation and Diagnosis: Three patients underwent primary assessment using the ABCDE approach, serial GCS evaluation, vital sign monitoring, laboratory investigations, and non-contrast head computed tomography (CT) scan. Based on clinical findings and initial GCS scores of 9–11, all patients were diagnosed with moderate traumatic brain injury. **Management:** Patients received emergency management according to trauma protocols, including airway stabilization, oxygen therapy, intravenous isotonic fluid administration, head elevation, blood pressure control, and osmotic therapy when indicated. Serial GCS assessments were performed to monitor neurological changes during treatment. **Outcome:** Two patients demonstrated neurological improvement, with GCS increasing from 11 to 13 and 10 to 11, respectively, whereas one patient remained at GCS 9 and required endotracheal intubation. Patients with multiple comorbidities experienced more complex management and less favorable short-term neurological outcomes than those without significant comorbidities. **Conclusion:** Serial Glasgow Coma Scale assessment is a practical and reliable bedside tool for monitoring real-time neurological changes and evaluating immediate emergency management outcomes in patients with moderate traumatic brain injury. This case series also suggests that comorbidity profiles may influence short-term neurological recovery and should be considered when interpreting serial GCS changes.

Keywords: Case series; Comorbidity; Emergency department; Glasgow Coma Scale; Moderate traumatic brain injury.

INTRODUCTION

Moderate traumatic brain injury (mTBI) is a common emergency condition associated with significant morbidity and mortality. Delayed or inadequate management may result in secondary brain injury, including cerebral edema, intracranial hemorrhage, increased intracranial pressure, and cerebral ischemia (Pratiwi & Sutawan, 2021). Therefore, early assessment and prompt management are essential. The Glasgow Coma Scale (GCS) is widely used to assess the level of consciousness, determine injury severity, and monitor neurological changes in patients with traumatic brain injury (Teasdale et al., 2014). Head injury remains a major public health problem worldwide, with traffic accidents accounting for 37.1% of cases, followed by falls from height

(23.9%) (Ghazwan Lafta & Hayder Sbahi, 2023). In Indonesia, head injuries account for 11.9% of all injury cases (Nurfikasari et al., 2025). At Panembahan Senopati Regional Hospital Bantul, 273 patients with head injury were treated in the Emergency Department between May and October 2025. Although serial GCS assessment is a standard component of emergency neurological monitoring, limited case series have described how changes in serial GCS reflect early management outcomes among patients with different comorbidity profiles during the emergency phase. Because comorbid conditions may influence physiological responses, neurological recovery, and management complexity, interpreting serial GCS changes requires consideration of the patient’s overall clinical condition rather than relying solely on GCS scores. Patients with moderate traumatic brain injury require prompt neurological assessment and continuous monitoring because early neurological deterioration may occur despite an initially stable clinical presentation (Robinson, 2021). This case series describes three patients with moderate traumatic brain injury and different comorbidity profiles to illustrate how serial GCS assessment can support evaluation of early neurological changes and immediate emergency management outcomes. The findings may contribute to emergency nursing and anesthesiology practice by highlighting the importance of interpreting serial GCS assessments alongside patients’ comorbidities during the initial management of traumatic brain injury.

CASE PRESENTATION

Table 1. Baseline Characteristics of the Three Patients

Characteristics	Case 1	Case 2	Case 3
Age/Sex	23/M	35/F	58/M
Mechanism of injury	Motorcycle accident	Bathroom fall	Fall from tree
Comorbidities	None	Hypertension	HT, T2DM, chronic pulmonary disease
Initial GCS	E3V3M5 (11)	E3V3M4 (10)	E2V2M5 (9)
Blood pressure	150/95	180/85	175/100
MAP	113	117	125
SpO ₂	96%	90%	94%
Laboratory findings	Leukocytosis, low RBC, low hematocrit	Leukocytosis, low RBC, low hematocrit	Leukocytosis, low RBC, low hematocrit
CT findings	Diffuse cerebral edema	Temporal fracture, cerebral edema	Basilar skull fracture, cerebral edema

Case 1

A 23-year-old male was admitted to the Emergency Department following a motorcycle accident without wearing a helmet, presenting with decreased consciousness, severe headache, nausea, and one episode of vomiting. He had no history of systemic disease, allergies, previous surgery, or regular medication use. On admission, the patient was somnolent with a Glasgow Coma Scale (GCS) score of E3V3M5 (11), consistent with moderate traumatic brain injury. Vital signs showed blood pressure 150/95 mmHg, heart rate 96 beats/minute, respiratory rate 22 breaths/minute, temperature 36.8°C, oxygen saturation 96%, and MAP 113 mmHg.

Physical examination revealed headache and vomiting without active external bleeding. Pupils were isocoric and reactive, capillary refill time was ≤ 2 seconds, and no deformity or fracture was identified. Non-contrast head CT demonstrated diffuse cerebral edema without intracranial hemorrhage.

Case 2

A 35-year-old female was admitted to the Emergency Department after a fall in the bathroom following worsening dizziness. She had a two-year history of uncontrolled hypertension due to poor treatment compliance. On admission, she was somnolent with a GCS score of E3V3M4 (10). Vital signs showed blood pressure 180/85 mmHg, heart rate 96 beats/minute, respiratory rate 22 breaths/minute, temperature 36.8°C, oxygen saturation 90%, and MAP 117 mmHg. Physical examination revealed gurgling breath sounds, indicating a threatened airway, a bleeding frontal laceration, reactive isocoric pupils, capillary refill time ≤ 2 seconds, and no deformity or fracture. Immediate airway management was performed, including airway positioning, suctioning, oxygen administration using a non-rebreathing mask, and stabilization according to the ABCDE approach before further evaluation. Non-contrast head CT demonstrated a linear temporal calvarial fracture with cerebral edema without intracranial hemorrhage.

Case 3

A 58-year-old male was admitted to the Emergency Department 30 minutes after falling from a tree (approximately 3 m). He presented with decreased consciousness, incomprehensible verbal sounds, headache, and epistaxis. He had controlled hypertension, type 2 diabetes mellitus, and chronic pulmonary disease following COVID-19. On admission, he was somnolent with a GCS score of E2V2M5 (9). Vital signs were blood pressure 175/100 mmHg, heart rate 130 beats/minute, respiratory rate 26 breaths/minute, temperature 36°C, oxygen saturation 94%, and MAP 125 mmHg. Physical examination revealed epistaxis, reactive isocoric pupils, capillary refill time ≤ 2 seconds, and no deformity or fracture. Non-contrast head CT suggested a basilar skull fracture with cerebral edema. Because of multiple comorbidities and progressive respiratory deterioration, advanced airway management was subsequently required.

CLINICAL REASONING

Table 2. Differential diagnosis considered during clinical reasoning

Differential Diagnosis	Supporting Findings	Reasons for Exclusion
Mild traumatic brain injury	History of head trauma	Initial GCS scores (9–11) were below the mild TBI range (13–15).
Severe traumatic brain injury	Decreased consciousness after trauma	Initial GCS scores remained above 8, therefore all patients were classified as moderate TBI.
Intracranial hemorrhage	Head trauma with altered	Non-contrast head CT showed no

	consciousness	significant intracranial hemorrhage or midline shift in all three patients.
Stroke	Altered level of consciousness	Clinical presentation followed traumatic injury, and CT findings were consistent with traumatic brain injury rather than cerebrovascular disease.

The final diagnosis in all three cases was moderate head injury. Clinical decision-making was based on the mechanism of injury, neurological examination, Glasgow Coma Scale (GCS) score, vital signs, and head CT findings. In all three patients, GCS scores ranged from 9–12, fulfilling the diagnostic criteria for moderate head injury. Neuroimaging demonstrated cerebral edema in all cases, with additional temporal bone fracture in Case 2 and suspected basilar skull fracture in Case 3, while significant intracranial hemorrhage and midline shift were excluded. These findings, together with the absence of clinical deterioration consistent with severe traumatic brain injury, supported the diagnosis of moderate head injury (Teasdale et al., 2014). Serial GCS assessment was selected as the primary indicator of management success because it provides a rapid, practical, and standardized method for detecting dynamic neurological changes during emergency treatment. Changes in GCS scores were interpreted together with clinical findings, hemodynamic status, and radiological results to evaluate the effectiveness of emergency management. In Cases 2 and 3, pre-existing comorbidities, including hypertension, type 2 diabetes mellitus, and chronic pulmonary disease, increased the complexity of clinical management and required closer neurological and hemodynamic monitoring throughout emergency care (Taneo et al., 2023).

DIAGNOSTIC ASSESSMENT

Table 3. Summary of relevant diagnostic findings

Examination	Result	Clinical Interpretation
Laboratory test	Case 1: Leukocyte $12.5 \times 10^3/\mu\text{L}$; erythrocyte $4.20 \times 10^6/\mu\text{L}$; hematocrit 38%. Case 2: Leukocyte $18.9 \times 10^3/\mu\text{L}$; erythrocyte $4.30 \times 10^6/\mu\text{L}$; hematocrit 38.7%. Case 3: Leukocyte $17.5 \times 10^3/\mu\text{L}$; erythrocyte $4.20 \times 10^6/\mu\text{L}$; hematocrit 37%.	Laboratory findings demonstrated leukocytosis with mild reductions in erythrocyte count and hematocrit, consistent with an acute inflammatory response following traumatic brain injury.
Imaging examination	Case 1: Head CT demonstrated diffuse cerebral edema with sulcal effacement, loss of gray-white matter differentiation, and ventricular compression. No intracranial hemorrhage or midline shift was identified. Case 2: Non-contrast head MSCT demonstrated a left temporal bone fracture with sinus hemorrhage and cerebral edema. No intracranial hemorrhage or midline shift was detected.	Neuroimaging confirmed diffuse cerebral edema (Case 1), left temporal bone fracture with sinus hemorrhage and cerebral edema (Case 2), and basilar skull fracture with cerebral edema (Case 3), without significant intracranial hemorrhage or midline shift.

Examination	Result	Clinical Interpretation
	Case 3: Head CT demonstrated a basilar skull fracture with cerebral edema. No significant intracranial hemorrhage or midline shift was identified.	
Clinical scoring / other assessment	Case 1: Initial GCS 11 (E3V3M5); GCS after management 12 (E3V4M5). Case 2: Initial GCS 10 (E3V3M4); GCS after management 11 (E3V3M5). Case 3: Initial GCS 9 (E2V2M5); GCS after management 9 (E2V2M5).	Serial Glasgow Coma Scale (GCS) assessment demonstrated neurological improvement in Cases 1 and 2, whereas Case 3 remained neurologically unchanged during Emergency Department management, supporting serial GCS as a practical indicator of short-term management outcomes.

THERAPEUTIC INTERVENTIONS AND CLINICAL PROGRESSION

Case 1

Upon arrival at the Emergency Department following a motorcycle accident, the patient underwent primary assessment using the ABCDE approach (ATLS Committee, 2023). Due to decreased consciousness (GCS 11) and vomiting, suctioning of approximately 10 mL of white secretions was performed to maintain airway patency and prevent aspiration. Oxygen therapy was administered via nasal cannula at 3 L/min. Intravenous treatment included 0.9% sodium chloride, ondansetron 4 mg IV, paracetamol 1 g IV, mannitol 20% 50 mL IV, and midazolam 1 mg IV before CT scan to facilitate neuroimaging by minimizing patient movement. Head elevation at 30° was maintained to optimize cerebral perfusion and reduce intracranial pressure (Pratiwi & Sutawan, 2021). Continuous monitoring of GCS, vital signs, oxygen saturation, and neurological status was performed. Following treatment, the patient's GCS improved from 11 (E3V3M5) to 13 (E4V4M5), indicating neurological improvement. The patient was subsequently referred to a higher-level healthcare facility for further management. These interventions were aimed at optimizing oxygenation, maintaining cerebral perfusion, reducing intracranial pressure, and preventing secondary brain injury (Nurfikasari et al., 2025).

Case 2

Upon admission to the Emergency Department, the patient underwent primary assessment using the ABCDE approach (ATLS Committee, 2023). Because of gurgling breath sounds and the risk of airway obstruction, suctioning was performed to maintain airway patency. Oxygen therapy was administered using a non-rebreathing mask at 10 L/min. Because oxygenation remained inadequate, bag-valve-mask ventilation was subsequently provided. Pharmacological management included mannitol 20% (0.5 g/kgBW IV), ondansetron 4 mg IV, paracetamol 1 g IV, and nicardipine infusion starting at 5 mg/hour with dose titration according to blood pressure response. The frontal laceration was irrigated with 0.9% sodium chloride and sutured under local anesthesia with lidocaine 1% (3 mL). Head elevation at 30° was maintained to promote cerebral venous drainage and reduce intracranial pressure (Pratiwi & Sutawan, 2021). Continuous monitoring of GCS, vital signs, oxygen saturation, and neurological status was performed. Following stabilization, the patient's GCS

improved from 10 (E3V3M4) to 11 (E3V3M5), indicating neurological improvement. The management aimed to optimize oxygenation, control intracranial pressure, stabilize hemodynamics, and prevent secondary brain injury while maintaining patient safety (Pratiwi & Sutawan, 2021).

Case 3

Following a fall from a height of approximately three meters, the patient underwent primary assessment using the ABCDE approach (ATLS Committee, 2023). Airway patency was maintained through suctioning, and oxygen therapy was initiated via nasal cannula at 5 L/min. However, progressive oxygen desaturation developed despite supplemental oxygen, requiring endotracheal intubation to secure the airway and provide ventilatory support. Rapid sequence intubation was performed using midazolam, fentanyl, propofol, and atracurium. Circulatory stabilization included insertion of two 18G intravenous lines, administration of 0.9% sodium chloride 500 mL IV, nicardipine infusion, mannitol 20% 100 mL IV, and paracetamol 1 g IV. Head elevation at 30° was maintained to promote cerebral venous drainage (Pratiwi & Sutawan, 2021). Continuous monitoring included serial GCS assessment, pupillary response, vital signs, oxygen saturation, blood glucose, urine output, and ECG monitoring. After stabilization, the patient was referred to a higher-level hospital with neurosurgical services. These interventions were intended to maintain airway protection, optimize oxygenation and cerebral perfusion, control intracranial pressure, and prevent secondary brain injury (Nurfikasari et al., 2025). Early management of cerebral edema is a key component of neurocritical care because it helps minimize secondary neurological injury in patients with traumatic brain injury (Cook et al., 2020).

CASE TIMELINE

Table 4. Clinical case timeline case 1

Time	Clinical Event	Investigation	Treatment	Outcome
19 February 2026 16.00 WIB	Patient arrived at the ED after a motorcycle accident without wearing a helmet, presenting with decreased consciousness, headache, nausea, and vomiting.	Primary survey (ABCDE), GCS E3V3M5 = 11, blood pressure, heart rate, respiratory rate, and oxygen saturation assessment.	Airway management and suction performed.	Airway remained patent.
16.10 WIB	Risk of hypoxia identified.	Oxygen saturation monitoring.	Oxygen therapy via nasal cannula at 3 L/min.	Oxygenation improved; SpO ₂ remained stable.
16.20 WIB	Signs suggestive of increased intracranial pressure.	Serial neurological examination and GCS monitoring.	Head elevation 30°, mannitol 20% IV, and 0.9% NaCl IV administered.	Cerebral perfusion maintained and neurological status remained stable.
16.30 WIB	Persistent headache, nausea, and vomiting.	Clinical reassessment including vital signs.	Paracetamol 1 g IV and ondansetron 4 mg IV.	Symptoms improved.

16.40 WIB	Agitation noted before CT examination.	Neurological observation.	Midazolam 1 mg IV.	Patient became calmer and CT examination could be performed.
16.50 WIB	Neurological re-evaluation.	Repeat GCS, blood pressure, heart rate, respiratory rate, and oxygen saturation assessment.	Continued observation.	GCS improved from 11 (E3V3M5) to 13 (E4V4M5); patient was referred to a higher-level healthcare facility.

Table 5. Clinical case timeline case 2

Time	Clinical Event	Investigation	Treatment	Outcome
15 March 2026 08.30 WIB	Patient arrived at the ED after a fall in the bathroom with decreased consciousness and dizziness.	Primary survey (ABCDE), GCS E3V3M4 = 10, blood pressure, heart rate, respiratory rate, and oxygen saturation assessment.	Initial stabilization performed.	Moderate head injury identified.
08.35 WIB	Airway compromise risk due to gurgling breath sounds.	Airway assessment and oxygen saturation monitoring.	Suction performed.	Airway remained patent.
08.40 WIB	Persistent inadequate oxygenation.	Respiratory assessment and oxygen saturation monitoring.	Oxygen therapy using a non-rebreathing mask at 10 L/min.	Oxygenation improved.
08.50 WIB	Severe hypertension and signs of increased intracranial pressure.	Hemodynamic and neurological monitoring.	Mannitol 20% IV and nicardipine infusion initiated.	Hemodynamic status improved.
09.15 WIB	Frontal laceration with persistent bleeding.	Wound assessment.	Wound irrigation using 0.9% NaCl, lidocaine infiltration, and suturing.	Bleeding controlled.

09.30 WIB	Neurological re-evaluation.	Repeat GCS, blood pressure, heart rate, respiratory rate, and oxygen saturation assessment.	Continued monitoring.	GCS improved from 10 (E3V3M4) to 11 (E3V3M5).
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Table 6. Clinical case timeline case 3

Time	Clinical Event	Investigation	Treatment	Outcome
25 March 2026 14.30 WIB	Patient arrived at the ED after falling from a tree (± 3 m) with decreased consciousness and epistaxis.	Primary survey (ABCDE), GCS E2V2M5 = 9, blood pressure, heart rate, respiratory rate, and oxygen saturation assessment.	Initial stabilization initiated.	Moderate head injury with suspected basilar skull fracture identified.
14.35 WIB	Blood and secretions causing gurgling breath sounds.	Airway assessment.	Suction performed.	Airway temporarily maintained.
14.40 WIB	Increased work of breathing.	Respiratory assessment and oxygen saturation monitoring.	Oxygen therapy via nasal cannula at 5 L/min.	Oxygenation temporarily maintained.
14.45 WIB	Hypertension and tachycardia observed.	Hemodynamic monitoring and ECG monitoring.	Two 18G IV lines inserted, 0.9% NaCl 500 mL IV administered, nicardipine infusion started.	Hemodynamic status improved.
14.50 WIB	Decreased consciousness with signs of increased intracranial pressure.	Serial GCS assessment and pupillary examination.	Head elevation 30°, mannitol 20% IV, and midazolam 1 mg IV administered.	Neurological status closely monitored.
15.15 WIB	Ongoing monitoring while awaiting CT examination.	Neurological examination, blood glucose, and vital signs monitoring.	Urinary catheter insertion and ECG monitoring continued.	Patient remained under close observation.

15.30 WIB	Hematemesis with worsening oxygen saturation.	Repeat airway and respiratory assessment.	Suctioning and lateral positioning performed.	Oxygen saturation remained inadequate.
15.45 WIB	Persistent respiratory deterioration despite oxygen therapy.	Airway reassessment.	Decision made to perform endotracheal intubation.	Advanced airway management indicated.
15.50 WIB	Preparation for rapid sequence intubation.	Pre-intubation assessment.	Midazolam, fentanyl, propofol, and atracurium administered according to institutional protocol.	Patient prepared for intubation.
16.00 WIB	Endotracheal intubation successfully performed.	Tube placement, chest expansion, breath sounds, oxygen saturation, and vital signs assessment.	Ventilation maintained using bag-valve ventilation.	Airway secured and oxygenation improved.
16.10 WIB	Post-intubation re-evaluation.	Repeat neurological assessment, oxygen saturation, blood pressure, heart rate, respiratory rate, and tube position assessment.	Continued monitoring and ventilatory support.	Oxygenation improved and ventilation became adequate without immediate complications.
16.20 WIB	Final assessment before referral.	Repeat airway, breathing, circulation, neurological assessment, and post-intubation GCS documentation according to medical records.	Ongoing stabilization and referral preparation.	Patient stabilized and referred to a Type B hospital with neurosurgical facilities for further management.

OUTCOME AND FOLLOW-UP

Case 1

Following emergency management in the Emergency Department (ED), the patient's neurological status improved, as demonstrated by an increase in the Glasgow Coma Scale (GCS) from 11 (E3V3M5) on admission

to 13 (E4V4M5) at the final assessment. Hemodynamic and respiratory status remained stable throughout the observation period, with no evidence of secondary neurological deterioration or other acute complications. After initial stabilization in the ED, the patient was referred to a higher-level hospital for further evaluation and management.

Case 2

Following emergency management, the patient's neurological status improved, with the GCS increasing from 10 (E3V3M4) on admission to 11 (E3V3M5) during ED observation. Blood pressure and oxygenation improved following antihypertensive therapy and respiratory support, while no further neurological deterioration or systemic complications were observed. After stabilization, the patient continued further management according to the treating physician's recommendations after discharge from the Emergency Department.

Case 3

The patient with a suspected basilar skull fracture underwent continuous neurological, respiratory, and hemodynamic monitoring in the Emergency Department. During observation, the patient developed hematemesis, resulting in progressive airway compromise and worsening oxygenation, which necessitated endotracheal intubation. Following successful intubation, adequate ventilation and oxygenation were achieved, and no immediate intubation-related complications were observed. Because the patient was intubated and sedated, neurological assessment after intubation was interpreted with consideration of the effects of sedation and neuromuscular blockade. After initial stabilization, the patient was referred to a Type B hospital with neurosurgical services for definitive management.

DISCUSSION

The three cases demonstrate that emergency management of moderate traumatic brain injury (TBI) should be individualized according to the patient's clinical presentation and comorbid conditions. Although all patients were initially classified as having moderate TBI, their outcomes differed. Cases 1 and 2 showed improvement in Glasgow Coma Scale (GCS) scores following emergency management, whereas Case 3 experienced clinical deterioration requiring endotracheal intubation and referral to a higher-level hospital. These findings are consistent with previous studies showing that patients with similar injury severity may have different clinical outcomes depending on associated injuries and underlying comorbidities (Ghazwan Lafta & Hayder Sbahi, 2023). Serial GCS assessment was useful in evaluating treatment response during Emergency Department (ED) management by providing an objective indicator of neurological changes during the emergency phase, consistent with recent recommendations on quality indicators for traumatic brain injury care (Jeffcote et al., 2025). Improvement in GCS in Cases 1 and 2 reflected favorable neurological recovery following airway management, oxygen therapy, intracranial pressure control, and hemodynamic stabilization. In contrast, neurological assessment in Case 3 became more challenging after intubation because sedation may influence GCS scoring. Therefore, serial GCS should be interpreted together with clinical findings, vital signs, and airway status rather than as a single indicator. This finding supports previous recommendations that serial GCS remains a practical tool for monitoring neurological status and guiding clinical decision-making in moderate TBI (Maas et al., 2022). From a nursing perspective, continuous neuroprotective nursing care, including serial neurological assessment and timely intervention, is essential to reduce the risk of secondary brain injury during the acute management of traumatic brain injury (Promlek et al., 2021). The poorer clinical course in Case 3 may be related to hypertension, type 2 diabetes mellitus, and chronic pulmonary disease, which can impair cerebral autoregulation, reduce oxygen reserve, and increase the risk of secondary brain injury. The occurrence of hematemesis further increased the risk of aspiration and contributed to the need for definitive airway management. These findings highlight the importance of continuous neurological monitoring using serial GCS together with repeated assessment of vital signs and airway status in patients with moderate TBI. The main strength of this case series is the comparison of three patients with different clinical characteristics,

demonstrating the practical value of serial GCS in emergency management. However, long-term follow-up was not available; therefore, neurological recovery beyond the ED and changes in GCS after referral or hospitalization could not be evaluated. These findings are consistent with the latest Best Practices Guidelines for Traumatic Brain Injury, which emphasize structured assessment, early resuscitation, and individualized management to minimize secondary brain injury (The American College of Surgeons, 2024).

DIAGNOSTIC CHALLENGE

The main diagnostic challenge in these cases was the need for rapid assessment and clinical decision-making in patients with moderate traumatic brain injury presenting with different clinical manifestations before definitive CT imaging became available. Initial neurological evaluation relied primarily on clinical examination, serial Glasgow Coma Scale (GCS) assessment, vital signs, and airway evaluation. In Case 2, severe hypertension could mimic or coexist with signs of increased intracranial pressure, requiring careful interpretation of neurological findings while awaiting CT imaging. In Case 3, the occurrence of hematemesis, together with underlying chronic pulmonary disease, increased the risk of aspiration and complicated airway assessment, leading to the decision to perform endotracheal intubation before CT confirmation. These challenges highlight the importance of integrating serial GCS assessment with the patient's overall clinical condition to support timely emergency management before definitive imaging results become available.

LIMITATION

This case series has several limitations that should be considered when interpreting the findings. First, it includes only three cases, which limits the generalizability of the results to a broader patient population. Second, patient observation was limited to the period of care in the Emergency Department (ED), preventing assessment of long-term clinical outcomes and recovery. Third, the analysis was based on available clinical records, diagnostic findings, and monitoring data documented during ED management, making the findings dependent on the completeness and consistency of medical documentation. Therefore, the findings primarily reflect the initial management and short-term outcomes of patients with moderate traumatic brain injury rather than their long-term prognosis. Future prospective case series with larger sample sizes and longer follow-up are needed to further evaluate the role of serial Glasgow Coma Scale (GCS) assessment as an indicator of management outcomes in patients with moderate traumatic brain injury.

LEARNING POINTS

1. Serial Glasgow Coma Scale (GCS) assessment is a practical and reliable indicator for monitoring neurological changes and evaluating the effectiveness of emergency management in patients with moderate traumatic brain injury.
2. Patients with moderate traumatic brain injury and comorbidities, such as uncontrolled hypertension, type 2 diabetes mellitus, and chronic pulmonary disease, require closer neurological and physiological monitoring because these conditions may complicate clinical assessment and management.
3. Changes in serial GCS, together with respiratory and hemodynamic findings, facilitate early recognition of clinical deterioration and support timely interventions, including airway protection when indicated.
4. Patients with the same initial GCS may require different emergency management strategies depending on clinical presentation, associated injuries, and comorbidities, as demonstrated in these three cases.
5. Individualized management based on serial GCS assessment, continuous monitoring, and the patient's overall clinical condition is essential to optimize outcomes in moderate traumatic brain injury.

CONCLUSION

This case series describes the management of three patients with moderate traumatic brain injury who had different comorbidity profiles: no comorbidity, a single comorbidity (hypertension), and multiple comorbidities (hypertension, type 2 diabetes mellitus, and chronic pulmonary disease following COVID-19 infection). Differences in serial Glasgow Coma Scale (GCS) trends were observed among the three patients. The patient without comorbidities demonstrated the greatest improvement in GCS (11 to 13), the patient with hypertension showed slight improvement (10 to 11), whereas the patient with multiple comorbidities

maintained a GCS score of 9 during Emergency Department observation and required endotracheal intubation because of hematemesis and airway compromise. These observations suggest that comorbidities may influence clinical progression, management complexity, and serial GCS changes in patients with moderate traumatic brain injury. However, because this case series included only three patients and observations were limited to the Emergency Department, these findings should be interpreted as observational and hypothesis-generating rather than conclusive evidence. Further larger case series and prospective studies are needed to confirm the relationship between comorbidities, serial GCS changes, and clinical outcomes.

ETHICAL CLEARANCE

Ethical approval was obtained from the Health Research Ethics Committee of Universitas 'Aisyiyah Yogyakarta with approval number 5255/KEP-UNISA/II/2026.

PATIENT CONSENT

Written informed consent for publication of this case series and related clinical data was obtained from the patients or their legal guardians. All identifying information has been removed to protect patient confidentiality and privacy.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to the writing and publication of this The authors declare that there is no conflict of interest regarding the publication of this case series.

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AUTHORS' CONTRIBUTION

Restria Dewi Fibrianti contributed to the conceptualization of the study, data collection, clinical analysis, manuscript drafting, and preparation of the final manuscript. Endah Tri Wulandari and Aisyah Nur Azizah contributed to study supervision, critical review of the manuscript, and approval of the final version of the manuscript.

DATA AVAILABILITY

The data supporting this case report cannot be shared publicly due to patient confidentiality and ethical restrictions.

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LIST OF ABBREVIATIONS

ABCDE = Airway, Breathing, Circulation, Disability, Exposure; COVID-19 = Coronavirus Disease 2019; CT = Computed Tomography; ED = Emergency Department; ECG = Electrocardiography; EDH = Epidural Hematoma; GCS = Glasgow Coma Scale; ICH = Intracerebral Hemorrhage; IV = Intravenous; MAP = Mean Arterial Pressure; MCV = Mean Corpuscular Volume; MCH = Mean Corpuscular Hemoglobin; MCHC = Mean Corpuscular Hemoglobin Concentration; MPV = Mean Platelet Volume; MSCT = Multi-Slice Computed Tomography; NRM = Non-Rebreathing Mask; PCT = Prokalsitonin; RDW-SD = Red Cell Distribution Width–Standard Deviation; SAH = Subarachnoid Hemorrhage; SDH = Subdural Hematoma; SpO₂ = Peripheral Oxygen Saturation

FIGURE AND TABLE LEGENDS

Table 1. Summary of Relevant Diagnostic Findings.

Table 2. Clinical Case Timeline of Case 1.

Table 3. Clinical Case Timeline of Case 2.

Table 4. Clinical Case Timeline of Case 3.

No figures were included in this manuscript.

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