Journal of Preventive and Population Health
https://jpphealth.com/

CASE REPORT

Occupational high-energy pedestrian traumatic brain injury associated with anisocoria and complex lower-extremity fractures without losing consciousness: a case report

Malak Mohammed Alshabi

Full list of author information is available at the end of the article.

ABSTRACT

Background: Complex injuries involving several organ systems can be caused by high-energy occupational trauma. Patients who first seem neurologically intact may have traumatic brain injury (TBI), especially if there are more obvious orthopedic impairments. Finding modest neurological abnormalities that might affect treatment choices still requires careful clinical screening.

Case Presentation: A 64-year-old hypertensive male came to our emergency department (ED) as a result of being struck by a vehicle at work. Witnesses said he briefly lost consciousness at the scene and could not remember what occurred afterward. On admission, his Glasgow Coma Scale (GCS) was 15, and he was conscious. Anisocoria was noted on neurological examination. Computed tomography of the brain demonstrated a small right frontal cerebral contusion with mild surrounding edema and an associated subgaleal hematoma, without skull fracture or midline shift. A complicated injury was shown by radiological scans of the right lower leg: a comminuted fracture of the upper third of the fibula with slight displacement and soft tissue edema, a spiral fracture of the distal tibia extending into the ankle, and fractures of the medial malleolus and fibula. The patient had open reduction and internal fixation of the distal tibial and medial malleolar fractures with an ankle arthrotomy following a multidisciplinary evaluation and confirmation of physiological stability. The patient had a straightforward surgical course and was observed for neurological and hemodynamic issues in the critical care unit.

Conclusion: High-energy occupational pedestrian trauma may lead to clinically significant neurological and orthopedic injuries, despite an obviously comforting appearance. The case's sustained awareness and normal GCS score did not rule out TBI since anisocoria prompted additional tests and showed a frontal cerebral contusion.

Keywords: Occupational trauma, polytrauma, traumatic brain injury, anisocoria, lower-extremity fractures, orthopedic fixation.

Introduction

Occupational injuries remain an important public health concern because of their contribution to mortality, disability, and socioeconomic burden [1]. High-energy workplace trauma, particularly injuries related to transportation incidents, may result in complex injuries requiring rapid assessment, appropriate prioritization, and coordinated multidisciplinary management [2].

Because of the significant energy imparted during contact, pedestrian-vehicle incidents rank among the most serious causes of blunt trauma [3]. Although

Correspondence to: Malak Mohammed Alshabi
*Care Hospital
Email: malakalshabi.ma@gmail.com
Received: 03 August 2026 | **Accepted:** 22 August 2026

the lower extremities are frequently affected by these injuries, traumatic brain injury (TBI) may have a substantial impact on clinical outcomes. It should be considered when evaluating patients with high-energy mechanisms [4].

Although the Glasgow Coma Scale (GCS) remains an essential component of TBI assessment, clinical findings and imaging results should be interpreted together, as patients with apparently preserved consciousness may still have intracranial injuries requiring monitoring and management [5].

Pupillary examination is an important part of neurological assessment following head trauma [6]. Abnormal pupillary findings, including anisocoria, require careful evaluation because they may indicate underlying neurological pathology and should not be overlooked even in patients without obvious deterioration in consciousness [7].

Individualized decision-making is necessary when managing individuals who have both significant orthopedic injuries and concurrent traumatic brain damage [8]. The patient's physiological state, any related injuries, and the likelihood of complications all influence when to treat a fracture [9]. While final fixation may be considered in carefully chosen individuals who maintain physiological stability, damage control orthopedics (DCO) offers a solution for unstable patients [10].

We describe a case of high-energy occupational pedestrian trauma that resulted in complicated distal tibial and ankle fractures that required surgical fixation, as well as a frontal cerebral contusion that presented with anisocoria despite a GCS of 15 on admission.

Case Presentation

A 64-year-old hypertensive male came to our emergency department (ED) as a result of being struck by a vehicle at work. Witnesses said he briefly lost consciousness at the scene and could not remember what occurred afterward.

When the patient was admitted to the hospital, their blood pressure was 140/80 mmHg, their GCS was 15, and they were stable and conscious. Anisocoria was noted on neurological examination: the left pupil was 2 mm and responded slowly, whereas the right pupil was 1 mm and non-reactive. There were no sensory or motor impairments. He had a hematoma on his right frontal scalp and facial bruising. His neck was stabilized using a cervical collar. A chest examination showed equal air entry and little discomfort. Pelvic and abdominal exams were normal. The right lower limb was deformed, swollen, and uncomfortable. Initially, there were concerns about blood flow because the limb was cold and had no pulses. A follow-up examination, however, showed normal neurovascular function and pulses.

The laboratory investigation reported a slightly prolonged prothrombin time (17.0 s, INR 1.17), little metabolic acidosis, and total creatine kinase was slightly elevated (261 U/L). An initial stress response is consistent with the elevated C-reactive protein (9.71 mg/L). The total serum protein slightly decreased (63.5 g/L).

Non-contrast computed tomography (CT) of the brain showed a tiny right frontal cerebral contusion with mild surrounding edema and a corresponding right frontal subgaleal hematoma. There was no midline shift or skull fracture. Except for minor degenerative alterations, the thoracic spine CT scan revealed good alignment and no new bone damage. X-ray scan of the right lower leg showed a complex injury: a spiral fracture of the distal tibia extending into the ankle, fractures of the medial malleolus and fibula, and a comminuted fracture of the upper third of the fibula with mild displacement and soft tissue edema (Figure 1).

The patient had an ankle arthrotomy, open reduction and internal fixation (ORIF) for the distal tibial fracture, and ORIF for the medial malleolar fracture using cannulated screws (Figure 2). The postoperative course was uneventful. The patient was admitted to the intensive care unit for close neurological and hemodynamic monitoring, pain management, and routine post-operative care.

Discussion

High-energy occupational trauma presents a diagnostic challenge because the severity of the mechanism does not always correlate with the initial clinical appearance. Additionally, Patients involved in high-energy collisions may present with stable vital signs and preserved consciousness while still having clinically relevant injuries [1, 2]. Therefore, early trauma assessment should include systematic evaluation of neurological status, possible life-threatening injuries, and associated musculoskeletal damage [1, 2]. While the GCS score is widely utilized, its sensitivity is limited

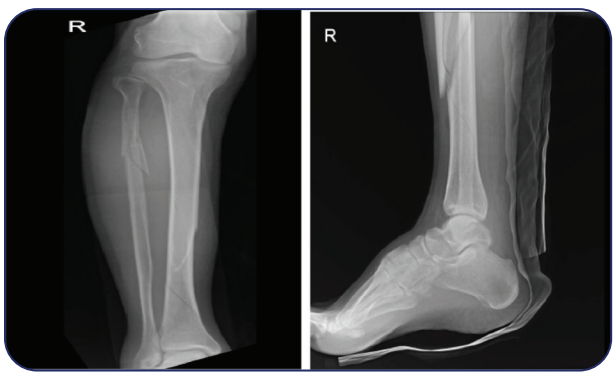

Figure 1. Pre-operative X-ray of the right lower leg demonstrating a complex distal tibial fracture extending into the ankle joint, medial malleolar fracture, and associated fibular fractures.

Figure 2. Post-operative X-ray demonstrating open reduction and internal fixation (ORIF) of the distal tibial fracture and cannulated screw fixation of the medial malleolus.

in detecting subtle or early intracranial lesions [10]. In elderly patients or those with high-energy mechanisms, normal initial GCS scores may delay the recognition of evolving contusions or extra-axial injuries [11]. In our patient, despite a baseline GCS score of 15, physical detection of anisocoria was the key clinical finding that prompted urgent neuroimaging and identified the frontal contusion.

Pupillary abnormalities mandate rigorous clinical evaluation [6, 7]. Although a small frontal contusion without midline shift is rarely the sole driver of classical anisocoria, identifying pupillary asymmetry in blunt trauma necessitates urgent cranial CT to exclude life-threatening structural mass effects [7]. In this instance, even though the GCS was normal, anisocoria was noted on neurological examination, where the left pupil was 2 mm and responded slowly, whereas the right pupil was 1 mm and non-reactive. Further neurological tests were needed.

Blood analyses are mainly performed based on the pre-existing evidence that traumatic injuries can generate biochemical responses that result in a modified metabolism of proteins, amino acids, and other components of the human body [12]. In our case, slightly raised inflammatory markers and creatine kinase revealed acute tissue injuries.

The management of polytrauma patients has evolved from universal early total care toward individualized strategies dictated by physiological stability [10]. While DCO is prioritized for unstable or borderline patients, particularly to minimize secondary neurological insult in severe TBI [13], early definitive fixation remains safe for physiologically stable individuals. In our case, physiological stability and limited intracranial pathology safely permitted early definitive ORIF of the distal tibia and medial malleolus rather than a staged damage-control approach.

The successful control of this patient was supported by coordinated multidisciplinary care involving trauma, orthopedic, neurological, anesthesia, and intensive care teams. Structured trauma approaches such as Advanced Trauma Life Support (ATLS) provide a framework for systematic evaluation and prioritization of injuries in patients with complex trauma [14]. In our case, multidisciplinary evaluation confirmed preserved neurological status without significant intracranial mass effect.

The combination of high-energy occupational pedestrian trauma, temporary loss of consciousness, anisocoria despite preserved consciousness, cerebral contusion without mass effect, and complex distal tibia–ankle fractures represents an uncommon clinical presentation, even though the individual injuries described in this patient are well known. This case stresses the need for multidisciplinary care and the necessity of a comprehensive evaluation of trauma patients who appear stable.

Conclusion

High-energy occupational pedestrian trauma may lead to clinically significant neurological and orthopedic injuries, despite an obviously comforting appearance. The case's sustained awareness and normal GCS score did not rule out TBI since anisocoria prompted additional tests and showed a frontal cerebral contusion. This study also emphasizes the importance of a comprehensive neurological evaluation, appropriate imaging, and tailored multidisciplinary decision-making when treating cases with severe trauma. Early diagnosis of minor neurological symptoms and careful fracture management plan selection may be beneficial for cases with both substantial orthopedic injuries and TBI.

List of Abbreviations

GCS	Glasgow Coma Scale
ED	emergency department
TBI	traumatic brain injury
DCO	Damage control orthopedics

Conflict of interests

The authors declare that they have no competing interests.

Funding

No external funding was received for this work.

Consent for publication

The patient gave written informed consent for publication of this study and related images.

Availability of data and materials

The text contains all related radiological and clinical data supporting this case report.

Authors' contributions

All authors contributed to clinical data collection, manuscript preparation, critical revision, and approval of the final version of the manuscript.

Ethical approval

Ethical approval and patient consent were obtained according to the rules of the participating institution.

Author details

Malak Mohammed Alshabi

Care Hospital

REFERENCES

1. Nunes JP, Niu S, Halim GM, Papandrea D, Hoibl A. Safe and healthy working environments for all: Realizing the fundamental right to a safe and healthy working environment worldwide. In World Congress on Safety and Health at Work 2023. ILO.
2. World Health Organization. WHO/ILO joint estimates of the work-related burden of disease and injury, 2000-2016: technical report with data sources and methods.
3. Brainard BJ, Slauterbeck J, Benjamin JB. Fracture patterns and mechanisms in pedestrian motor-vehicle trauma: the ipsilateral dyad. J Orthop Trauma. 1992;6(3):279–82. https://doi.org/10.1097/00005131-199209000-00002
4. Peng Y, Hu Z, Liu Z, Che Q, Deng G. Assessment of pedestrians' head and lower limb injuries in tram-pedestrian collisions. Biomimetics (Basel). 2024;9(1):17. https://doi.org/10.3390/biomimetics9010017
5. Carney N, Totten AM, O'Reilly C, Ullman JS, Hawryluk GW, Bell MJ, et al. Guidelines for the management of severe traumatic brain injury, fourth edition. Neurosurgery. 2017;80(1):6–15. https://doi.org/10.1227/NEU.0000000000001432
6. Oddo M, Taccone F, Galimberti S, Rebora P, Citerio G; Orange study group. outcome prognostication of acute brain injury using the neurological pupil index (ORANGE) study: protocol for a prospective, observational, multicentre, international cohort study. BMJ Open. 2021;11(5):e046948. https://doi.org/10.1136/bmjopen-2020-046948
7. American College of Surgeons Committee on Trauma. Advanced Trauma Life Support (ATLS): Student Course Manual. 11th ed. Chicago (IL): American College of Surgeons; 2023.
8. Li LM, Dilley MD, Carson A, Twelftree J, Hutchinson PJ, Belli A, et al. Management of traumatic brain injury (TBI): a clinical neuroscience-led pathway for the NHS. Clin Med (Lond). 2021;21(2):e198–205. https://doi.org/10.7861/clinmed.2020-0336
9. Moore TA, Simske NM, Vallier HA. Fracture fixation in the polytrauma patient: markers that matter. Injury. 2020;51(Suppl 2):S10–4. https://doi.org/10.1016/j.injury.2019.12.024
10. Pape HC, Giannoudis PV, Krettek C. The timing of fracture treatment in polytrauma patients: relevance of damage control orthopedic surgery. J Orthop Trauma. 2005;19(8):551–7. https://doi.org/10.1097/01.bot.0000161712.87129.80
11. Klingebiel FK, Oertel MF, Kalbas Y, Balogh ZJ, Beeres FJ, Coimbra R, et al.; IMPACT group - International MultidisciPlinAry Consensus panel on polyTrauma. Timing of definitive fracture fixation in patients with concomitant traumatic brain injuries - A systematic review of the literature by the IMPACT group. Eur J Trauma Emerg Surg. 2025;51(1):308. https://doi.org/10.1007/s00068-025-02981-w
12. Popal Z, Schepers T, van Schie P, Giannakopoulos G, Halm J. The use of routine laboratory testing in acute trauma care: a retrospective analysis. Ulus Travma Derg. 2022;28(7):954–9. https://doi.org/10.14744/tjtes.2021.14826
13. Halvachizadeh S, Pfeifer R, Duncan J, Klingebiel FK, Kalbas Y, Berk T, et al. Does the injury pattern drive the surgical treatment strategy in multiply injured patients with major fractures? J Trauma Acute Care Surg. 2024;96(6):931–7. https://doi.org/10.1097/TA.0000000000004252
14. Vadan IM, Grad D, Strilciuc S, Stefanescu E, Verisezan Rosu O, Michalak M, et al. Glasgow Coma Scale score at admission in traumatic brain injury patients: a multicenter observational analysis. J Clin Med. 2025;14(15):5195. https://doi.org/10.3390/jcm14155195