



Editorial

Prioritizing and Strengthening the Subspecialty of Traumatic Brain Injury and Neurocritical Care



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Received: August 27, 2026 | Revised: September 13, 2026 | Accepted: September 14, 2026 | Published online: September 28, 2026

Traumatic brain injury (TBI) is a major cause of death and disability among young and middle-aged adults. China's large TBI patient population makes continuity of care a substantial clinical and organizational challenge.¹ Severe TBI is particularly time-sensitive because of high prehospital mortality and the narrow therapeutic window for limiting secondary brain injury. Care therefore depends on coordination from scene management and prehospital transport to emergency assessment, neurocritical care, and early rehabilitation.¹ These demands extend beyond the capabilities of any single specialty or institution. International consensus likewise emphasizes integrated approaches encompassing prevention, prehospital emergency care, in-hospital critical care, and rehabilitation, rather than reliance on a single therapeutic intervention.²

This dependence on continuity changes what subspecialty development needs to achieve. Its value lies in integrating "one team, one platform, and a suite of technologies" into a cohesive care system. Prioritizing TBI and neurocritical care therefore involves a transition in neurosurgery from "single-point technical expertise" to "system-level capability." The practical challenge is to sustain that capability both within hospitals and across the regional patient pathway.

Such a system begins with a multidisciplinary team that maintains responsibility across the patient pathway. Patients with severe TBI may face simultaneous threats involving the airway, breathing, circulation, intracranial pressure, infection, and multi-organ dysfunction. Their care requires joint decision-making by neurosurgery, emergency medicine, critical care, anesthesiology, rehabilitation, nursing, radiology, laboratory medicine, and other disciplines. Ad hoc consultations may address individual problems but are unlikely to establish a continuous and stable chain of responsibility. Experience with TBI care units supports organized multidisciplinary care and shared decision-making.³ Neurocritical care also provides an organizational basis for integrating specialty-based interventions across the care pathway.⁴ A fixed team thus preserves disciplinary expertise while replacing temporary con-

sultation-based arrangements with standing collaboration, defined accountability, and structured review.

For this collaboration to function reliably, teams need a shared platform that supports timely decisions and coordinated action. Neurocritical care units (NCCUs), trauma centers, emergency resuscitation areas, rapid-access imaging and laboratory pathways, transport systems, and teleconsultation platforms provide the necessary infrastructure. Their value lies in organizing complex TBI care into coordinated and executable clinical workflows.³ Platform development therefore requires more than an accumulation of equipment and beds. Imaging, laboratory testing, operating-room access, NCCU admission, and transport need explicit time targets and responsibilities within the care pathway.

Within that framework, technologies can be organized into coordinated clinical actions. Surgery, airway management, intracranial pressure monitoring, multimodal neuromonitoring, damage-control strategies, early rehabilitation, and organ support should form executable bundles rather than isolated procedures. Guidelines for severe TBI provide an evidence-based basis for these bundles and support consistency at key decision points across centers.⁵ Implementation should distinguish core-center technologies for complex care from foundational technologies that can be delivered across the wider network. Both depend on teams that can select appropriate interventions and platforms that support their timely delivery, underscoring the interdependence of team, platform, and technology.

This combination is illustrated by the Department of Neurosurgery at Shanghai Changzheng Hospital, Second Affiliated Hospital of Naval Medical University. With TBI as a major clinical focus, the department integrates neurosurgical emergency care, inpatient services, NCCU care, neurointervention, and neurorehabilitation through relatively stable multidisciplinary workflows. This provides an organizational illustration of how teams, platforms, and technologies can be integrated across the care continuum. Comparative outcome data would be needed to assess its effectiveness and transferability.

Integration within a hospital, however, addresses only part of a pathway that begins before admission and often crosses institutional boundaries. China's trauma-care policies provide a framework for extending coordination across that pathway. The National Health Commission has promoted trauma-center development and established the National Center for Trauma

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How to cite this article: Hou L. Prioritizing and Strengthening the Subspecialty of Traumatic Brain Injury and Neurocritical Care. *Neurosurgical Subspecialties*. Published online: Sep 28, 2026. DOI: <https://doi.org/10.14218/NSSS.2026.00027>.

Medicine with Peking University People's Hospital as its principal institution. *The Notice on Further Improving Trauma-Care Capacity* calls for coordination among prehospital emergency care, in-hospital emergency services, and specialty care. Research on China's trauma-care system summarizes this approach as the "123 Initiative": one region under local government leadership, two links connecting prehospital with in-hospital emergency care and emergency services with relevant specialties, and three teams spanning prehospital, emergency, and specialty care.⁶ Together, these elements support the "1+X" model, in which one trauma center coordinates multiple trauma-care sites within a regional closed-loop system.⁶

For TBI, this regional framework needs to connect recognition, transport, and admission with NCCU care, multidisciplinary decisions, and rehabilitation follow-up. Information gaps or unclear responsibility at transitions can undermine care, while establishing a trauma center alone does not resolve delayed prehospital recognition, fragmented consultation, or inadequate critical-care capacity. Within this regional framework, we propose that the TBI and neurocritical care subspecialty function as a specialty core and quality-control node. Its contribution is to connect specialist expertise with the emergency-care network through explicit referral pathways and shared responsibility for continuity of care.

Maintaining these connections requires resources for readiness and coordination as well as for treatment itself. Emergency and trauma-care systems need sustained support for infrastructure, workforce capacity, and information exchange, with priorities informed by regional service gaps.⁶ Their unpredictable workload and time-sensitive decisions make disease burden and service volume insufficient as the sole bases for allocation. The relevant question is therefore which local gaps impede timely care, rather than whether one category of care should take precedence nationally.

Recent registry studies help distinguish unmet service needs from evidence of improved outcomes. A 2026 analysis of East of England Trauma Audit and Research Network data from 2013–2021 identified capacity pressures and disparities in specialist-care access.⁷ These findings support region-specific planning, while US data caution against judging capability by volume alone. An analysis of National Trauma Data Bank data found lower adjusted mortality in 2017–2021 than in 2007–2011.⁸ Higher center volume, however, was not associated with lower mortality in the later period.⁸ A 2025 Georgia Trauma Quality Improvement Program study found improved risk-adjusted outcomes during implementation of American College of Surgeons verification requirements linked to continued trauma funding.⁹

In China, a 2023 single-center propensity score-matched study reported lower in-hospital mortality after trauma-center establishment, with 109 matched patients per group.¹⁰ In the matched groups, mortality was 11.0% after establishment versus 22.0% beforehand.¹⁰ These findings support evaluating coordinated care alongside the resources needed to deliver it. The observational design does not isolate the effect of financial investment or establish a causal benefit for TBI-specific outcomes. Investment should therefore be coupled with assessment of care processes and outcomes, so that regional priorities can be tested and refined.^{6–10}

For TBI, strengthening regional capability also means reaching

the settings where patients first receive care. Advanced neurosurgical and neurocritical care capabilities are concentrated primarily in tertiary hospitals, yet opportunities to prevent secondary injury begin in prehospital and primary-level settings. Specialist expertise therefore needs to be translated into actions that frontline personnel can perform and assess. These include airway and oxygenation/ventilation management, maintenance of blood pressure and cerebral perfusion, early recognition of neurological deterioration, and standardized referral and transport.^{5,11} The aim is to disseminate setting-appropriate capability through recognizable warning signs, initial management steps, and clear referral thresholds, rather than reproduce the equipment or operative scope of a tertiary center.

Delivering these actions consistently requires training matched to each provider's role. Large centers should undertake complex surgery, multimodal neuromonitoring, and difficult critical-care decisions, while primary-level and emergency personnel concentrate on stabilization, early recognition, and referral. Severe TBI guidelines can inform the standardized care bundles used in training.⁵ Training should therefore be assessed through the application of these shared practices, rather than familiarity with equipment alone.

A shared pathway also depends on using assessment tools for the decisions they are designed to support. The Abbreviated Injury Scale and Injury Severity Score should be used appropriately for anatomical injury characterization, trauma registries, and quality assessment.¹² Prehospital triage and referral instead require field-triage criteria based on mental status, vital signs, injury patterns, mechanism of injury, and emergency medical services judgment.¹³ These criteria should be adapted to local resources and referral capacity. Keeping these functions distinct connects immediate referral decisions with reliable data for subsequent quality assessment.

These requirements translate into four linked priorities for subspecialty development. First, team, platform, and technology should be assessed together as a unified framework. We propose that assessment include multidisciplinary team stability, NCCU function, completeness of quality-control data, and patient outcomes, alongside surgical volume and bed capacity. This would provide a common benchmark for identifying gaps in institutional capability and monitoring improvement.

Second, that institutional assessment should extend to the connections between providers within the regional system. The "123 Initiative" offers a framework for defining responsibilities across prehospital recognition, initial treatment, transport, NCCU admission, and rehabilitation follow-up.⁶ Trauma centers, primary receiving facilities, and prehospital emergency services should use agreed information interfaces and referral criteria.¹³ Injury-scoring terminology should remain consistent for registry-based quality assessment.¹² The priority is accountable transitions between services, rather than simply increasing the number of centers.

Third, the gaps identified through these assessments should guide resource allocation. Investment in emergency, trauma, and neurocritical care platforms should be aligned with documented regional needs and evaluated against care processes and patient outcomes. Measures should include time to treatment, complications, preventable mortality, and functional outcomes, rather than service volume alone. Continued evaluation is therefore essential

when applying these approaches to TBI.⁷⁻¹⁰ Future regional comparisons should assess whether better coordination is accompanied by improved TBI-specific functional outcomes, a benefit that the cited studies do not establish.

Fourth, resources directed toward frontline care should support the training needed to put shared pathways into practice. Stratified training, simulation exercises, and annual refresher programs should address airway management, cerebral perfusion, recognition of neurological deterioration, and standardized transport. Training based on guideline-informed care bundles should be linked to quality review and outcome evaluation.^{5,11} This connection would help identify whether appropriate technologies are becoming reproducible clinical capabilities across the network.

Ultimately, prioritizing TBI and neurocritical care means sustaining responsibility for the patient across services, institutions, and stages of recovery. The team-platform-technology framework provides an organizational basis for this continuity, while regional coordination extends its reach. Its value should be judged by whether it enables timely, consistent care and improves patient outcomes, with those benefits evaluated rather than assumed.

Acknowledgments

None.

Funding

None.

Conflict of interest

Dr. Lijun Hou has served as an Executive Associate Editor of *Neurosurgical Subspecialties* since July 2024. The author has no other conflicts of interest to declare.

Author contributions

Dr. Lijun Hou, as the sole author, was responsible for the conception and design, literature review, drafting, critical revision, and final approval of the manuscript.

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