

Advancing Towards a Targeted Surveillance Strategy in Traumatic Brain Injury

Avançando Rumo à Estratégia de Vigilância Dirigida no Traumatismo Crânio-Encefálico

Vítor MOURA GONÇALVES^{1,2}

Acta Med Port 2025 Feb;38(2):68-70 • <https://doi.org/10.20344/amp.22775>

Keywords: Anticoagulants; Costs and Cost Analysis; Craniocerebral Trauma/diagnostic imaging; Craniocerebral Trauma/economics; Tomography, X-Ray Computed

Palavras-chave: Anticoagulantes; Custos e Análise de Custos; Tomografia Computorizada; Traumatismo Crânio-Encefálico/diagnóstico por imagem; Traumatismo Crânio-Encefálico/economia

Traumatic brain injury (TBI) is a major global healthcare problem, with significant economic and social implications. Managing TBI in patients with coagulopathy represents a substantial challenge for emergency departments due to the lack of consensus on balancing clinical benefit and resource allocation. Current national clinical guidelines for TBI, established by Portugal's Directorate-General of Health in 1999,¹ recommend 24-hour in-hospital surveillance with serial cranioencephalic CT scans for TBI patients with coagulopathies, even when initial imaging shows no intracranial lesions. However, evidence supporting this practice is limited, raising concerns about resource use, especially as healthcare costs rise.² The increasing prevalence of coagulopathic patients further underscores the urgent need for evidence-based recommendations.

Previous research by Ribeiro da Costa *et al*³ offers compelling evidence that challenges the clinical relevance and cost-effectiveness of this practice. Their retrospective study, conducted at Unidade Local de Saúde de Santo António, provides a comprehensive economic evaluation comparing the current surveillance protocol (scenario A) with a hypothetical model (scenario B) where patients with normal initial CT scans are discharged without further imaging or surveillance. Among 440 patients, only 0.4% had new intracranial lesions on 24-hour follow-up CTs, none of which required targeted therapeutic intervention. Despite the minimal clinical findings, the current surveillance model incurred direct costs of €163 157 (n = 436 patients) compared to €29 480 (n = 440 patients) under the hypothetical scenario – a fivefold cost increase.³ Moreover, the current model required twice as many emergency department shifts (9 vs 4.6 shifts), highlighting a substantial burden on medical staff.³

The findings align with international data showing similarly low rates of delayed intracranial hemorrhage (DIH) in comparable cohorts and question the utility of routine

24-hour surveillance for this specific subset of patients.² Controversies over DIH definition are not covered in this analysis. A national study by Duarte-Batista *et al*⁴ reported a 2.3% DIH incidence among hypocoagulated patients, with no cases requiring neurosurgical intervention. Similar studies demonstrate that the risk of DIH in anticoagulated patients is low,^{3,5} and that oral anticoagulants do not increase the risk of DIH⁵ nor influence clinical outcomes.⁶

The present study raises important questions about the sustainability of the current surveillance strategy, which may have future implications for clinical practice. Economic analyses also corroborate these findings. Alali *et al* highlighted the importance of cost-effective strategies in TBI management, emphasizing the need for selective guidelines based on individual risk factors.⁷ Collectively, these studies underscore the disproportionate resource allocation required for current surveillance practices, thus advocating for a more tailored approach. As global healthcare budgets face increasing pressures with escalating expenses, it is imperative to achieve a balance between clinical effectiveness and economic sustainability through the adoption of evidence-based and cost-efficient practices. Economic evaluations play a pivotal role in guiding resource allocation and aligning clinical outcomes with financial viability. For example, the Portuguese National Health Service (SNS) could save an estimated €9.3 million over a decade by adopting a more selective approach.³ This would not only alleviate financial strain but also ensure that resources are directed to patients with the greatest clinical need. The operational burden of mandatory 24-hour surveillance significantly limits the availability of critical resources for higher-risk patients.

While the intention of surveillance is to mitigate risks, the non-negligible but relatively low incidence of DIH in coagulopathic patients with normal imaging prompts serious debate about the need for intensive monitoring. Predictive models that incorporate individual risk factors could guide

1. Department of Neurosurgery. Hospital Lusíadas Lisboa. Lisboa. Portugal.

2. Faculty of Medicine. University of Porto. Portugal.

✉ **Autor correspondente:** Vítor Moura Gonçalves. vg81@sapo.pt

Recebido/Received: 22/12/2024 - **Aceite/Accepted:** 02/01/2025 - **Publicado/Published:** 03/02/2025

Copyright © Ordem dos Médicos 2025



targeted decision-making and more selective surveillance algorithms. These models could align clinical efforts with patient-specific risks, which may include, among other factors, high-energy trauma, presence of additional injuries, skull fractures, non-TBI trauma above the clavicle level, Glasgow Coma Score (GCS) < 15, neurological deterioration (decrease in GCS \geq 2 points), age over 65, absence of home supervision, high risk of recurrent falls, prior neurosurgery, post-traumatic severe headache, loss of consciousness, amnesia, and/or vomiting.^{2,3} Such an approach could enhance resource allocation and efficiency.

These insights challenge the status quo and highlight the urgent need for updated guidelines that prioritize both patient safety and resource management. In their research, Ribeiro da Costa *et al*³ certainly do not intend to dismiss the potential risks associated with TBI in coagulopathic patients. Rather, they aim to advocate for a shift from indiscriminate surveillance to a stratified approach grounded in clinical evidence and risk assessment.

Transitioning to a targeted surveillance strategy could yield significant benefits. It would reduce the financial burden on the SNS while maintaining high standards of patient care. Updated guidelines reflecting contemporary evidence would improve emergency department adaptability and efficiency, particularly in resource-limited settings. Strategies such as risk stratification models and predictive analytics could optimize surveillance algorithms.

Future research should focus on high-quality, multicenter studies to validate these findings, explore potential regional and institutional variations, assess long-term outcomes of updated guidelines, and improve the management of TBI in coagulopathic patients. Such research could further refine the cost-benefit dynamics in TBI management and support the development of evidence-based guidelines.

The widespread implementation of standardized TBI electronic registries across national emergency departments is essential for identifying risk factors for DIH, particularly among coagulopathic patients. The establishment of a comprehensive nationwide targeted TBI surveillance program is therefore imperative. Large cohort data from these registries would provide an alternative to randomized controlled trials, which are often challenging to conduct in emergency settings. Technologies like big data analytics, artificial intelligence (AI), and machine-learning hold significant promise for revolutionizing TBI management. Large datasets with extensive information enable these technologies to identify complex patterns and predictive factors that conventional methods may neglect, facilitating research and the development of guidelines. By analyzing patient

demographics, clinical data, injury mechanisms, laboratory results, and imaging findings, machine-learning algorithms could create personalized risk profiles. AI-driven prediction models may continually improve with new data, upgrading their accuracy over time and facilitating real-time decision-making in emergency settings. Such developments would enhance patient safety, optimize resource allocation, and decrease healthcare costs, therefore aligning clinical practices with the tenets of precision medicine and value-based healthcare.

Additionally, domiciliary hospitalization and telemedicine could reduce hospital stay costs and serve as valuable additions to TBI management guidelines for selected patients. Emerging biomarkers may also assist in stratifying TBI patients with coagulopathy.⁸

These tools and strategies would enable clinicians to direct surveillance towards high-risk patients while safely discharging those at lower risk, minimizing unnecessary interventions, reducing costs, and significantly enhancing resource allocation and clinical outcomes.

The study by Ribeiro da Costa *et al* challenges longstanding assumptions about the need for 24-hour in-hospital surveillance for coagulopathic TBI patients with normal initial CT scans. By highlighting the minimum clinical benefit and substantial economic burden of current practices, the study paves the way for a reevaluation of national and international guidelines with an indulgent eye. This evidence advocates for a shift toward more tailored surveillance strategies grounded in clinical evidence and economic evaluations.

Updated clinical guidelines should evolve alongside emerging evidence. By embracing a more comprehensive and data-driven approach to TBI surveillance, we can optimize outcomes for both patients and healthcare systems. Integrating economic evaluations into guideline development can prevent the implementation of costly and clinically ineffective practices. This paradigm shift will require collaborative efforts between clinicians, researchers, and policymakers, but the potential gains in efficiency and patient care make this effort worthwhile.

COMPETING INTERESTS

The author has declared that no competing interests exist.

FUNDING SOURCES

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Direção-Geral da Saúde. Protocolo nacional para a abordagem dos traumatismos crânio-encefálicos. 1999. [cited 2024 Nov 22]. Available from: <https://www.dgs.pt/directrizes-da-dgs/normas-e-circulares-normativas/circular-normativa-n-05gabdg-de-05051999-pdf.aspx>.
2. Mendiito VG, Rossetti G, Sampaolesi M, Buzzo M, Pomponio G. Traumatic brain injury in patients under anticoagulant therapy: review of management in emergency department. *J Clin Med*. 2024;13:3669.
3. Ribeiro Da Costa T, Batata R, Oliveira S, Fernandes A, Sousa S, Vaz Silva F, et al. Economic impact of surveillance of head trauma patients with coagulopathy and normal initial computed tomography scan (ECO-NCT). *Acta Med Port*. 2025;38:16-22.
4. Duarte-Batista P, Farinha NC, Marques R, Páscoa Pinheiro J, Silva J, Tuna R, et al. HIPTCN: prospective observational study of hypocoagulated head trauma patients with normal admission computed tomography scan. *Acta Med Port*. 2021;34:413-9.
5. Kwon H, Kim YJ, Lee JH, Kim S, Kim YJ, Kim WY. Incidence and outcomes of delayed intracranial hemorrhage: a population-based cohort study. *Sci Rep*. 2024;14:19502.
6. Mathieu F, Güting H, Gravesteijn B, Monteiro M, Glocker B, Kornaropoulos EN, et al. Impact of antithrombotic agents on radiological lesion progression in acute traumatic brain injury: a CENTER-TBI propensity-matched cohort analysis. *J Neurotrauma*. 2020;37:2069-80.
7. Alali AS, Burton K, Fowler RA, Naimark DM, Scales DC, Mainprize TG, et al. Economic evaluations in the diagnosis and management of traumatic brain injury: a systematic review and analysis of quality. *Value Health*. 2015;18:721-34.
8. Chiollaz AC, Pouillard V, Habre C, Seiler M, Romano F, Spigariol F, et al. Diagnostic potential of IL6 and other blood-based inflammatory biomarkers in mild traumatic brain injury among children. *Front Neurol*. 2024;15:1432217.