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It's Getting Better All the Time? Using Secular Trends to Understand the Impact of Neurocritical Care

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The field of neurocritical care has evolved substantially over the past two decades [1]. This has occurred coincident with development and implementation of evidence and consensus-based guidelines for a range of neurological conditions for which patients are referred to intensive care units, most notably traumatic brain injury (TBI) and various forms of stroke [2–4]. New tools for neuromonitoring of primarily cerebral function in acutely injured patients have transitioned from research to routine care, with continuous electroencephalography, intracranial pressure monitoring, and even brain tissue oxygen and cerebral microdialysis being utilized on a regular basis. Along with development of new monitoring tools and treatment guidelines, there comes the question of the optimal organization of critical care services in order to best implement these new approaches. Put more bluntly: does patient care delivered in a specialized neurocritical care unit or system make a difference?

Damian and colleagues utilized the large nationwide UK Intensive Care National Audit & Research Centre (ICNARC) database to address two basic questions: (1) is risk of mortality changing over time for patients with several different neurocritical care conditions (primary intracerebral hemorrhage [ICH], myasthenia gravis [MG], and Guillain-Barre syndrome [GBS]) who are treated in critical care units and (2) if so, is this change associated with the type of critical care unit in which the patient is treated [5]. By covering the years 1996–2009, they were able to identify over 10,000 ICH critical care admissions, over 1000 for MG, and over 1900 for GBS in this database which includes more than 80% of intensive care units (ICU) in England and Wales. In-hospital mortality was chosen as the primary outcome. Predictors such as length of stay, type of hospital admission, critical care disease severity score, and socioeconomic indicators were available for statistical adjustment although many disease specific parameters (e.g ICH hematoma volume, respiratory function studies for MG or GBS) were not available. In order to assess the impact of specialized neurocritical care, they divided hospitals somewhat arbitrarily into those with a specialized neurocritical care unit (NCCU), those with a general ICU and substantive availability of consultant neurologists (GICU-FNS) and those with only limited neurology consultation (GICU-LNS).

The principal findings were that in-hospital mortality for ICH and MG, but not GBS, patients treated in a critical care unit has steadily decreased over the 13 year study period and this decline was more marked for ICH patients treated in a NCCU. In a multivariate model, a higher level of neurocritical care support was associated with lower mortality for ICH patients, while there was no apparent effect of specialized neurocritical care on MG or

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GBS outcomes. Digging deeper, several other interesting findings emerge. When adjusting for the longer length of stay in neurocritical care units, the trend of lower ICH mortality with more neurocritical care support was abolished. Unfortunately, the authors were not able to provide more detailed information as to whether this longer length of stay was linked to more aggressive care and might therefore serve as a proxy for additional services provided to patients. Of great concern was the observation that the mortality risk was substantially higher than anticipated for MG and GBS patients and that most of this mortality occurred in the hospital but outside the ICU.

It is important to emphasize that this database only includes patients who were treated in an intensive care unit. Variability in triage decisions across countries may impact on the generalizability of the findings. Of note, about 60% of MG and GBS patients, and 89% of ICH patients were mechanically ventilated within the first day, suggesting that this cohort comprised a particularly sick group of patients. Even so, while the ICH in-hospital mortality is consistent with other studies [6], the MG and GBS mortality still seems high (about 14% even in the most recent time epoch studied) [7, 8]. Specific cause of death was not available, but the authors postulate that medical complications occurring post-critical care discharge may be responsible for this in MG and GBS patients and that care in an inpatient step-down unit after ICU discharge may play an important and underappreciated role, especially in these patients. Interestingly, the idea that limited availability of post-hospital discharge care and rehabilitation might negate potential gains from acute critical care has been brought up as a criticism (or perhaps more appropriately an observation) of the BEST-TRIP clinical trial of intracranial pressure monitoring performed in South America [9]. The intensive care unit is only one stop on the care pathway for our patients and really should not be considered in isolation, lest we win the battle but not the war.

So should large systems of care be reorganized so that most neurocritically ill patients, at least those with central nervous system problems such as ICH, can be cared for in a dedicated neurocritical care unit? In a disease with no treatment of proven benefit from randomized trials (ICH), it is encouraging that outcomes are improving over time and advances in neurocritical care are probably partly responsible. Expertise does matter and this study adds to the literature suggesting a positive effect of neurocritical care [10]. The conundrum remains as to why: More monitoring? Longer time in the ICU? More use of evidence-based guidelines? Less withdrawal of support? And finally, are these improved outcomes are sufficiently robust and reproducible as to justify the financial cost. This study does not address these over-arching questions.

The authors acknowledge the study's limitations. Lack of functional outcome data for ICH patients, absence of information on patients never treated in an ICU, and insufficient information on disease-specific aspects leave many questions about outcome relevance, referral bias, and residual confounding unaddressed. But as the American baseball player Yogi Berra, known for his offbeat aphorisms, stated, "You can observe a lot just by watching." Observation of secular trends is a useful and potentially underutilized way to keep us honest by watching whether we really are doing a better job for our patients over time.

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