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## Comparative effectiveness of surgery for traumatic acute subdural hematoma

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# Chapter 7

## Unmeasured confounding in observational studies of management of cerebellar intracranial hemorrhage

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To the Editor

In a propensity score–matched cohort of 578 patients from 4 observational cohort studies, Dr Kuramatsu and colleagues showed that evacuation of medium-sized intracerebellar hematomas (approximate volume, 20 cm<sup>3</sup>) was not associated with better functional outcome.<sup>1</sup> Assessing treatment effectiveness in observational data is challenging because treatment decisions are based on patient characteristics that also are typically predictive of outcome, causing confounding by indication. Although the authors addressed this potential bias with propensity scores, we would like to emphasize the possibility of residual confounding.

In their study, surgically treated patients were younger, had worse Glasgow Coma Scale scores at presentation, had larger hematomas, and more often had intraventricular hemorrhage. In matching patients with the same risk of undergoing a surgical evacuation (the propensity), the authors suggested that treatment groups with similar prognosis were created. However, while measured confounding seems to have been properly addressed, unmeasured confounding may still be a problem. Many factors may influence decision-making in these patients, including frailty and preexisting conditions that could be contraindications for surgery. Contexts with strong measured confounding are also likely to show substantial unmeasured confounding. Propensity score matching is a statistically efficient alternative for regression-based covariate adjustment but still relies on the assumption that no unmeasured treatment preferences strongly relate to prognosis.<sup>2,3</sup>

A methodological study on comparable treatment considerations found that unmeasured confounding is not merely a theoretical problem.<sup>3</sup> In post hoc analyses of traumatic brain injury cohorts, analytical methods for surgery in traumatic intracranial hematomas and intracranial pressure–guided treatment were compared; propensity score matching was unable to account for unmeasured imbalances between treatment groups. A simulation study confirmed that propensity score matching resulted in an invalid estimate of the treatment effect in the case of unmeasured confounding,<sup>3</sup> which also was shown in other fields.<sup>4</sup>

Our view is that unmeasured confounding is an insurmountable problem in observational studies of acute neurosurgical decisions. A promising alternative for effect estimation is instrumental variable analysis. Although this method has its own difficulties, such as defining appropriate instruments and the necessity of large samples, it is not biased by unmeasured confounding.<sup>3,5</sup> Since the cohort in the study by Kuramatsu and colleagues came from 64 centers with likely differing practice culture among institutions, have the authors considered a regional comparison of treatment strategies?

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