Navigating through the paradox of choice: prediction of outcome in aneurysmal subarachnoid hemorrhage

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Dear Editor,

In recent times there has been a considerable improvement in outcomes even for the initially poor grade aneurysmal subarachnoid hemorrhage (SAH), with the advancement in management guided by evidence. At the same time, the existence of several interventions with heterogenous results makes it challenging to select the optimal neurointensive management for such cases. There are available guidelines to help the neurointensivist in managing SAH cases [1, 2]. Prognostication holds supreme relevance in the comprehensive management of SAH, given the significant burden of morbidity and mortality associated with this menace. A significant number of patients who are discharged alive continue to suffer from an inferior quality of life, owing to neurocognitive deficit, memory impairment and overall poor functional outcome [3]. Therefore, it is extremely important to predict the outcome of the patients admitted with SAH to decide the treatment strategy, to meaningfully utilize resources, to communicate with the family and also to explore interventions which can be beneficial. Researchers have developed a number of predictive models consisting of clinical and radiological parameters for this purpose. Unfortunately, a systematic review published in 2012 revealed that the clinical prediction models were flawed with significant methodological heterogeneity and a lack of external validation [4]. Since then, a plethora of research has evaluated newer prediction models with methodological rigor and successful external validation.

We performed a literature search to find existing tools for predicting long-term outcomes in SAH.

A few of these models demand special mention. The 5-category Prognosis on Admission of Aneurysmal Subarachnoid Haemorrhage (PAASH) model solely depends on the Glasgow Coma Scale (GCS) [5]. In a very recent study, PAASH emerged as the preferred scale over the age old World Federation of Neurological Surgeons (WFNS) and Hunt and Hess (H&H) scales for predicting poor outcome because of better discriminatory ability to differentiate outcomes of the adjacent grades [3]. The Functional Recovery Expected after Subarachnoid Hemorrhage (FRESH) score includes Hunt & Hess and Acute Physiology and Chronic Health Evaluation II (APACHE-II) physiologic scores on admission, age, and aneurysmal rebleed within 48 hours. FRESH has two different scores to predict cognition (FRESH-cog) and the quality of life (FRESH-quol) at 1 year [6, 7]. To collect the data from different corners of the world in order to generate a prediction model, a Subarachnoid Hemorrhage International Trialists (SAHIT) repository was established [8]. This mammoth multinational cohort study resulted in the development of three prediction models: 1) a core model consisting of age, hypertension, World Federation of Neurosurgical Societies grade, 2) a neuroimaging model which includes the Fischer grade, size and site of the aneurysm and 3) a final model amalgamating the core and imaging model [9, 10]. In another study patients were classified into green, yellow and red categories using the VASOGRADE scale,

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which was created by a combination of the modified Fischer and WFNS grades. Although this model was initially used to predict the risk of delayed cerebral ischemia (DCI), it has shown good performance in predicting functional outcome as well [11, 12]. The Hemorrhage, Age, Treatment, Clinical State, Hydrocephalus (HATCH) score has also been externally validated for prediction of functional outcome [13]. Among purely radiological scores, the Hijdra sum score outperformed the Subarachnoid Hemorrhage Early Brain Edema Score (SEBES), Fischer, Claassen, Barrow Neurological Institute (BNI), and original Graeb scales in prediction of DCI, mortality and poor outcome of SAH [14]. With the ever increasing footprint of artificial intelligence in medicine, a number of predictive models have been formulated using machine learning tools in the recent past [15]. A number of biomarkers including enolase, S100B, and GFAP (glial fibrillary acidic protein) in blood and cerebrospinal fluid (CSF) have been evaluated for their accuracy in predicting mortality [16]. In addition to the previously used ones, dynamic changes in total tau in the cerebral microdialysate [17] and the CSF arginine/ornithine ratio are among the latest areas of interest [18]. An interesting online, visual dynamic nomogram has been proposed to predict the risk of adverse outcome at 6 months in elderly patients after undergoing endovascular therapy for aneurysmal SAH [19].

The above discussion points towards another challenge faced by the neurointensivist – how to effectively predict the outcome of SAH? Previously it was reasonable to conclude that these models had not been adequately validated. But with so many scales now externally validated, there is a need for the guideline committee to step in. With some scores providing readily available downloadable tools, links and QR codes for calculation, this dilemma can be addressed as a Schwartz paradox where more is actually less. Although one of the recent guidelines discussed these prediction tools, there is no clear recommenda-

tion yet [2]. The wealth of predictive scores, particularly many of them being developed in the very recent past, warrants special attention. The panel of experts in different guidelines shall focus on this aspect in the coming days and a recommendation after systematically reviewing the existing evidence shall be of help.

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