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Clinical Nihilism in Neuro-Emergencies

J. Claude Hemphill III, MD, MAS^a and Douglas B. White, MD, MAS^b

^a Associate Professor of Clinical Neurology and Neurological Surgery, University of California, San Francisco; Director, Neurocritical Care, San Francisco General Hospital

^b Assistant Professor of Medicine and Anesthesia. University of California, San Francisco. Director-UCSF Clinical Ethics Core

Abstract

Mortality and morbidity remain high from neurological emergencies such as acute stroke, traumatic brain injury, and hypoxic-ischemic encephalopathy after cardiac arrest. Decisions regarding initial aggressiveness of care must be made at the time of presentation and perceived prognosis is often used as part of this decision-making process. However, these decisions are predicated on the accuracy of early outcome prediction. Decisions to limit treatment early after neuro-emergencies must be balanced with avoidance of self-fulfilling prophecies of poor outcome due to clinical nihilism. This article examines the role of prognostication early after neuro-emergencies, the potential impact of early treatment limitations, and how these may relate to communication with patients and surrogate decision makers in the context of these acute neurological events.

Keywords

prognosis; do-not-resuscitate; withdrawal of support; intracerebral hemorrhage; traumatic brain injury

Prognostication matters [1]. This is especially true in the context of acute neurological emergencies. In patients with acute stroke, severe traumatic brain injury, or hypoxic-ischemic encephalopathy after resuscitation from cardiac arrest, treatment decisions are made not only based on risk-benefit ratio, but also with the consideration of whether any treatment is futile based on poor patient prognosis. Outcome prediction models for these and other acute neurological conditions have been developed, and some authors have suggested that these models should be used for early patient triage, including decisions to limit the use of life sustaining treatments [2]. The initial emergency department evaluation of a patient with one of these acute neurological conditions is a critical timepoint. It is often the point at which physicians (e.g. emergency medicine, neurologists, neurosurgeons, intensivists) make that pivotal decision to engage aggressively in evaluation and treatment or whether further treatment seems futile.

Arguments have been made that these very early decisions to limit treatment at the time of initial emergency assessment are ethically appropriate (so as to avoid prolonging suffering by delivering medical care which is futile) and financially important (so as to avoid high cost

aCorresponding Author for proof and reprints: J. Claude Hemphill III, MD, MAS, Department of Neurology, Room 4M62, San Francisco General Hospital, 1001 Potrero Avenue, San Francisco, CA 94110, Tel: (415) 206-3213, Fax: (415) 476-5582, Email: E-mail: chemphill@sfg.ucsf.edu.

^bCo-author Address: Douglas B. White, MD, MAS, University of California, San Francisco, Program in Medical Ethics, 521 Parnassus Ave, Suite C-126, Box 0903, San Francisco, CA 94143-0903, Telephone: (415) 502-8275, Fax: (415) 476-5020, Email: dwhite@medicine.ucsf.edu

medical care which has no chance to improve outcome) [3]. However, all of these considerations are predicated on the assumption that prognostication is sufficiently accurate and reliable to enable decision-making this early after an acute neurological catastrophe. This raises important concerns about how we prognosticate, how we use this information in individual patient decision-making in the emergency setting, and how we communicate this information to patients and their families. Finally, it leads to the fundamental question: *Is nihilism an effective treatment strategy in neuro-emergencies?*

What's the Prognosis, Doc?

Prognostication is inherent in every new patient encounter regardless of the medical condition being treated or its severity. Patients, and often their families and surrogates, always want to know “how am I going to do?” Although often not explicitly considered as prognostication, when a patient is told that their hand laceration will heal in several weeks or their headache should be gone by morning they are being offered a prognostic assessment as part of their evaluation and treatment. Yet, the importance of prognostication seems more relevant when a patient has a real chance of death or disability. Interestingly though, the concept of prognostication is often poorly understood and misused in the clinical context.

Prognosis is defined, according to the Merriam-Webster Dictionary, as “the prospect of recovery as anticipated from the usual course of disease or peculiarities of the case” [4]. Likewise, to *prognosticate* is “to foretell from signs or symptoms” [5]. Prognostication is the act of trying to tell the future. However, too often it is mistakenly taken to be the act of telling what will be, rather than what may be or is likely to be. In clinical practice, prognosis is frequently simplistically considered as a dichotomous outcome: is the prognosis good or bad? Yet, prognostication really involves two different aspects, basically (1) how good do you expect the patient to get, and (2) how sure do you want to be? In the setting of severe traumatic brain injury, a 90% likelihood of return to work at 6 months may be very different than a 50% likelihood of living at home under supervision at 1 year. Yet, both represent a prognosis. A prognosis is a probability of a possible outcome. Thus, uncertainty is an inherent aspect of prognostication in all but the most extreme cases. Accepting this uncertainty is central to using prognostic information appropriately in clinical decision-making. So how do we prognosticate in neuro-emergencies and are we good at it?

Does Prognostic Information affect Life Support Decisions in ICUs?

Murphy and colleagues found that elderly patients substantially overestimated the likelihood of success from cardiopulmonary resuscitation (CPR) and that their willingness to undergo CPR significantly decreased after receiving quantitative data on CPR outcomes [6,7]. Weeks and colleagues studied patients with metastatic cancer and found that those who significantly overestimated their chances of 6-month survival were more likely to choose aggressive treatment compared to those with a more accurate understanding, with no improvement in survival [8]. Fried and colleagues found that seriously ill patients' willingness to consent to life support declined substantially as the likelihood of death or severe functional impairment increased [9]. Lloyd and colleagues reported similar findings, with fewer than 25% of patients willing to undergo prolonged life support for a 20% chance of survival; this proportion declined further when the expected functional outcome was poor [10]. Taken together, these studies suggest that misunderstandings about prognosis may lead to use of life support that is inconsistent with patients' preferences. They also suggest that patients do not require prognostic certainty when faced with the decision whether to continue life support.

Zier and colleagues pursued surrogate decision makers' views of prognostic information [11]. Although all surrogates in the study judged prognostic information to be very important, more than half expressed doubt about physicians' prognostic accuracy. Moreover, the study

revealed that surrogates use physicians' prognostications as a 'cue' to initiate processes that helped them prepare for a decision to withdraw life support, including emotional preparation, beginning to say goodbye to the patient, and notification of distant family members to come to the hospital. In aggregate, these data suggest that most patients/surrogates in ICUs neither require absolute prognostic certainty in order to withdraw life support, nor believe that such certainty is possible. In addition these data suggest that although "brute prognostication" is unlikely to be an effective way to make decisions, physicians' prognostications remain important considerations for surrogates.

Outcome Prediction in Neuro-Emergencies

Many observational and epidemiological studies have been published which have identified various parameters which are predictive of outcome after acute neuro-emergencies. Most of these are comprised of clinical, radiological, and laboratory variables, many of which are available at the time of initial patient evaluation. Various outcomes have been used to develop these models, including short-term mortality and long-term functional outcome. Numerous formal prediction models or algorithms have been developed from these studies for several different conditions, including non-traumatic intracerebral hemorrhage (ICH), severe traumatic brain injury (TBI), and hypoxic-ischemic encephalopathy (HIE) after resuscitation from cardiac arrest.

Non-traumatic intracerebral hemorrhage remains without a treatment of proven benefit. Predictors of short-term mortality, and to a lesser degree long-term functional outcome, are relatively well described. Most ICH prediction models have found that clinical status, such as measured by the Glasgow Coma Scale (GCS) score or National Institutes of Health Stroke Scale (NIHSS), and hematoma volume are strong predictors of 30-day mortality risk and longer-term functional outcome. Other clinical predictors present in various models include age, presence and volume of intraventricular hemorrhage (IVH), infratentorial hemorrhage location, admission blood pressure, and coagulopathy [12–16]. The most commonly used ICH prediction model, the ICH Score, involves a sum score of points assigned for GCS [3–4 = 2, 5–12 = 1, 13–15 = 0], hematoma volume [≥ 30 ml = 1, < 30 ml = 0], presence of IVH [yes = 1, no = 0], infratentorial origin [yes = 1, no = 0], and patient age ≥ 80 [yes = 1, no = 0] [14]. ICH Scores may range from 0 to 6, and each increase in the ICH Score is associated with increased risk of 30-day mortality. While the ICH Score was developed to help standardize communication and risk stratification for ICH clinical care and clinical research, we have found clinicians increasingly tempted to use this as an early triage tool. Specifically, the first author of this manuscript has had other physicians suggest that patients with an ICH Score of 4 (predicted 30-day mortality of 97% in the original cohort) should not receive critical care or inter-facility transport because of perceived futility.

There are at least two problems with this approach. First, it assumes that a 3% chance of survival constitutes medical futility. To date, the only widely accepted definitions of futility are those that include only circumstances in which treatment *will not* accomplish the intended goals [17]. Second, there is considerable uncertainty around point estimates from such mortality prediction models. The fact that the 95% confidence interval of the mortality estimate in the above example extends from 81% to 100% (unpublished data), emphasizes this point.

In patients with extensive traumatic injury to the brain, predictors of death or disability include low GCS score after initial resuscitation, findings of intracranial hemorrhage or swelling on CT scan, older age, abnormal pupillary function, and hypotension early after injury [18]. In general, the motor aspect is the most reliable and informative part of the GCS score. However, current TBI guidelines emphasize that a low GCS score early after injury lacks precision for precise prediction of a poor outcome. Thus, the recognition of uncertainty remains.

Interestingly, there have been attempts to develop prediction models that would drive early decisions to limit care in TBI patients with a perceived poor prognosis. A mathematical model derived on 672 patients treated at a single center from 1978–1993 suggested that long-term prognosis could be sufficiently predicted at 24 hours after TBI accurately enough to terminate life sustaining treatments in patients unlikely to survive a severe head injury ($GCS \leq 8$) [2]. Notably however, the overall mortality in this cohort at 6 months was 58.8% which is nearly double that of most other series of patients with severe TBI [19–23]. Whether the extremely high mortality rate in this modeling study was due to physician bias in the care of severely ill TBI patients or other factors is unclear. However, it does clearly demonstrate the importance of understanding the context in which a particular prediction model is developed and deciding whether they are likely to apply to a specific patient (or population) in which care decisions are being made.

There have been many attempts to predict outcome in comatose survivors of cardiac arrest with HIE. Numerous studies have focused on clinical, neuroimaging, laboratory, and electrophysiological predictors. A commonly cited study published in 1985 described the outcome of patients with various clinical examination findings at different time points after resuscitation from cardiac arrest [24]. Generally findings at 3 days post-arrest have been considered the most informative. Other studies have examined the likelihood of an unfavorable outcome based on a range of predictors [25]. Importantly, recent practice parameters from the American Academy of Neurology suggested that, in the absence of brain death, clinical examination findings at day 3 of absent pupil or corneal reflexes or a motor response which was absent or no better than extensor had a sufficiently low false positive rate to reliably predict extremely poor long-term functional outcome [26]. This emphasizes that even in the setting of deep coma, some period of waiting is usually desirable to clarify the persistence and validity of clinical examination findings. Whether a trial of aggressive therapy (such as moderate hypothermia [27,28]) alters these predictive parameters in hypoxic-ischemic coma is not clearly known.

A common finding in these attempts to predict outcome early across various types of neuro-emergencies is intuitive. Patients in coma tend to do worse, especially if they are older. The finding of extensive injury on head imaging studies is also suggestive. The challenge is how to use this information in planning patient treatment. Many of these models and prediction tools described above have been validated and are used in various forms in the context of current clinical management. However, most of the time, clinicians prognosticate based not on a specific formal outcome prediction model, but rather on their own impressions based on experience, knowledge of the medical literature, and clinical intuition. This informal prognostic method is probably really an individual physician's internalized outcome prediction model. However, a central question is whether this informal method is accurate and consistent. Furthermore, recent work has raised the concern that inaccuracy or variability in prognostication could lead to self-fulfilling prophecies of poor outcome.

What is the Self-Fulfilling Prophecy?

A self-fulfilling prophecy is a prediction which becomes real or true by virtue of having been predicted or expected [29]. The term self-fulfilling prophecy is credited to the sociologist Robert K. Merton who described the self-fulfilling prophecy as “in the beginning, a *false* definition of the situation evoking a new behaviour which makes the original false conception come ‘true’”. This specious validity of the self-fulfilling prophecy perpetuates a reign of error. For the prophet will cite the actual course of events as proof that he was right from the very beginning” [30]. This stemmed from a concept described as the Thomas theorem: “If men define situations as real, they are real in their consequences” [31]. Even though these are modern terms, the concept of the self-fulfilling prophecy is a familiar and ancient one, as

evidenced by its central importance in Shakespeare's *Macbeth* and the Greek legend of Oedipus. But is this relevant to the treatment of neuro-emergencies in the 21st century? Potentially.

Take an example of a hypothetical cohort of 100 patients with severe stroke in which 70 of them die. Now assume that the death of about 70% of these patients was preceded by withdrawal of support [32]. If some proportion (for example: one quarter) of these patients in whom support was withdrawn might actually have survived, then the "true" mortality rate of the cohort was not 70%, but rather 58%. This would mean that 12 of the 49 patients who underwent withdrawal of support died as a result of a self-fulfilling prophecy. However, it is probably not possible to determine who among the group were those specific twelve patients. Furthermore, any outcome prediction model based on such a cohort would also be based in part on the self-fulfilling prophecy that had occurred.

Certainly in neuro-emergencies such as stroke, TBI, and HIE functional outcome is probably an even more important endpoint than mortality. However, patients must survive in order to improve. Thus, irrespective of the specific outcome measure chosen in a specific circumstance, the general goal of avoiding a self-fulfilling prophecy of poor outcome remains.

Does Prognostication Influence Outcome?

None of the prediction models developed for neuro-emergencies such as ICH, TBI, or HIE take into account factors related to treating physicians, such as their overall patient prognosis or whether they plan to aggressively treat or consider care limitations. However, as increasing attention is justifiably being paid to the importance of ethical and compassionate end-of-life care in critical illness [33], concerns are also being raised about the possibility of self-fulfilling prophecies of death or disability if treatment is limited in patients with high, but not absolute, risk of mortality [34,35].

Why might there be uncertainty? One central tenet is that outcome prediction models (either formal or informal) are made from studies of *populations* of patients, but decisions to limit treatment based on poor prognosis are made on *individual* patients. Prognosticating outcome in an individual patient using a model developed from a group of patients is inherently uncertain. In fact, prognostic models describe a probability of a specific outcome, such as dead or alive, but an individual patient can only have one of these outcomes. It becomes obvious that if a clinical decision rule is made such as to withdraw medical support in all patients with > 90% risk of death, then now 100% die. Prognostication, or at least the application of prognostic data, has changed prognosis.

Empirical evidence suggests this theoretical concern also is a real problem in the care of patients with neurological emergencies. In a single-center study of 87 ICH patients, Becker and colleagues found that the single most important prognostic variable in determining outcome was the level of medical support provided. In fact, withdrawal of support negated the predictive value of all other variables studied. Furthermore, they found wide heterogeneity across different physicians regarding their expectation of prognosis in the same patients. They suggested that treatment limitations, especially withdrawal of life support, might lead to self-fulfilling prophecies of poor outcome [34].

It is well recognized that heterogeneity exists in the use of various aggressive treatments for ICH, such as surgical hematoma evacuation [36], and this is not surprising given the lack of a proven effective treatment and the limited number of large clinical trials which have been performed in ICH [37–39]. However, this raises the question as to whether there is also heterogeneity in the use of measures to limit care early after ICH and whether this influences outcome. The 1983 U.S. President's Commission on Deciding to Forgo Life-Sustaining Treatment emphasized that a do-not-resuscitate (DNR) policy should ensure that the DNR

order has no implications for any other treatment decisions [40]. However, in practice DNR orders are often the first step in a continuum of care limitation [41]. Additionally, variability has been found in the use of DNR orders [42,43].

Hemphill and colleagues hypothesized that the rate at which a hospital uses DNR orders within the first 24 hours of ICH admission influences patient outcome irrespective of other hospital and patient characteristics. From a California-wide hospital discharge database, 8233 ICH patients treated at 234 different hospitals were identified [44]. Early DNR orders were one of the most common interventions, with 25% of patients having DNR orders within 24 hours of hospital admission. This was much higher than the proportion of patients who underwent aggressive interventions such as surgical hematoma evacuation or ventriculostomy placement. Of note, the rate at which a hospital used DNR orders within 24 hours of ICH patient admission increased the odds of individual patient death, even after adjusting for patient characteristics such as age, use of mechanical ventilation (a surrogate for coma), and hospital characteristics such as number of ICH patients treated or designation as a teaching hospital or trauma center. Even more importantly, there was an interaction between an individual patient's DNR status and the hospital DNR rate. This means that not only does the individual patient's DNR status matter, but it matters which hospital the patient is DNR in. Different hospitals (and presumably physicians) used DNR orders differently and this influenced a patient's risk of dying. These findings of early care limitations influencing outcome in acute ICH have been confirmed by others in a separate cohort of patients in Texas [45].

This type of analysis suggests several things. First, use of measures to limit treatment early is extremely common, at least in ICH. Second, it is not the DNR orders themselves that are leading to patient death. In fact, DNR orders should have no effect on patient outcome unless the patient has a cardiac arrest. Rather, high use of early DNR orders at a hospital is a marker of an overall non-aggressive approach to ICH patients in general and this suggests that there is something about the milieu of care in a hospital that influences outcome, potentially in a very negative way. Third, it clearly demonstrates that nihilism is an ineffective treatment strategy.

Likewise, for traumatic brain injury, the ability to precisely prognosticate accurately early has been questioned. Kaufmann performed a study in which 100 consecutive patients with severe TBI were evaluated to determine whether expected prognosis on day 1 was accurate [46]. Interestingly, it was found that an experienced neurosurgeon underestimated favorable one-year outcomes and overestimated poor outcomes. Notably, an experienced neuroradiologist did the opposite, overestimating favorable outcomes while underestimating poor outcomes. The authors concluded that in severe head injury, it was not possible to reliably predict outcome on the first day with sufficient accuracy to guide management at least for purposes of unilaterally limiting treatment.

It is noteworthy that these issues are not limited to acute neurological emergencies, but apply to general critical care as well. Rocker and colleagues found that physician estimates of a patient having a less than 10% likelihood of surviving to intensive care unit (ICU) discharge were associated with subsequent life support limitation. Furthermore, these estimates were more predictive of ICU mortality than illness severity itself [47]. In a different study, Frick found that physicians tended to be overly pessimistic about survival and quality of life of ICU patients. Additionally, ICU nurses tended to suggest treatment withdrawal more often than physicians for patients who ultimately survived [48].

These emerging studies of the association of early treatment limitation and outcome coupled with increasing recognition of the challenges of precisely prognosticating outcome very early in neuro-emergencies have engendered concern regarding how to balance issues of ensuring aggressive care for those patients who might benefit while avoiding the costs (both financially

and psychologically) of futile care. Many approaches now advocate a trial of “aggressive treatment” for at least some period of time in these neuro-emergencies such as ICH, TBI, and HIE if this is congruent with the patient’s wishes. The 2007 revision of the American Stroke Association Guidelines for the Management of Spontaneous Intracerebral Hemorrhage in Adults includes a new recommendation to carefully consider aggressive full care during the first 24 hours after ICH onset and to postpone new DNR orders during that time [49]. Perhaps most importantly, these emerging concerns have placed renewed focus on the goals of prognostication and this interacts with surrogate decision-making in the setting of acute neurological catastrophes.

What are We Trying to Achieve with Prognostication?

A central tenet of American bioethics is that medical care should reflect the values of the patient [50]. Although it is true that surrogates struggle to enact this standard of decision-making for incapacitated patients because of their difficulty in knowing what the patient would choose for him or herself, the problem is only compounded by misunderstandings about prognosis. Surrogates who are inaccurately pessimistic about prognosis may opt to forego treatment that the patient may have desired. Surrogates who have an overly optimistic view may choose life support in a setting in which the patient would not want it. In both circumstances, patient centered care is compromised. Moreover, when life support is continued in patients who would not choose it, this may create problems at a societal level because critical care services in the U.S. are an expensive and limited resource, for which demand sometimes exceeds supply [51]. The problem of resource scarcity is likely to grow as the aging population increases [52].

The most important role for prognostication in acute neuro-emergencies is in communicating risk. Prognostication is intrinsically linked to the process of communication in the care of severely ill patients. It is important to contrast this emphasis on communication and shared decision-making with some of the potentially darker aspects of prognostication, especially those which might reinforce early nihilism. The use of prognostic information to limit initial and early care because of physician nihilism due to anticipated futility is potentially problematic if this is not congruent with the patient’s (or family’s) wishes to attempt aggressive care, especially if true prognosis is perhaps less certain than that assumed by the physician. Since physicians generally cannot be compelled to provide specific medical or surgical interventions which are futile, the accuracy of prognosis is central to conflicts that arise between patient (or family) wishes and physicians about the intensity of care to be attempted. An additional argument frequently made is that high health care costs might be limited by limiting intensive care at the end-of-life. While this might seem intuitively correct when considering an individual patient’s health care costs, this may not be the case. Luce suggested that the fixed costs of ICU beds, hospital wards, and personnel such as nursing and respiratory therapists outweigh the variable costs of an individual patient’s hospitalization and that the only way to truly reduce costs in this manner may be to close beds and fire personnel [53].

We strongly favor using prognostic information to support shared decision-making with patients and families early in the setting of acute neuro-emergencies, rather than as a way to usurp their autonomy and deny or force care. This usually includes explaining, and even embracing, the uncertainty inherent in prognostication. Thus, our focus is increasingly on principles of communication and setting the stage for decision-making to come.

Many issues remain to be clarified. If prognostication at the time of an acute neuro-emergency is too imprecise to help inform medical decisions, then at what point is it sufficiently accurate? Is the concept of prognosis as a range of possible outcomes with various probabilities too complex for non-medical patients and families to understand? If we try a trial of aggressive

treatment, will we “miss” a window in which to withdraw support in a severely injured patient? These are all concerns which have been communicated to us by staff in our own medical centers. Yet, these concerns really bring us back to the importance of communication with patients and families in the context of acute illness, especially high-risk acute catastrophes such as stroke, TBI, and cardiac arrest. The challenge is how to implement this in a medically and ethically sound way.

Conclusions

The acute management of patients with neuro-emergencies such as stroke, TBI, and hypoxic-ischemic encephalopathy after cardiac arrest is not a simple task. Only a small number of interventions have been clearly shown in randomized trials to be of benefit, yet decisions regarding optimal care have to be made in every patient and often for numerous issues. Many times the first decision faced by physicians in this context is whether to ‘engage’ by pursuing a trial of aggressive treatment or ‘retreat’ and initiate approaches to limit treatment based on perceived poor prognosis. A better appreciation of the imprecision of early prognostication and the potential deleterious effects of early treatment limitations has served to emphasize the challenge of decision-making at this early critical point. Yet, even in the absence of a treatment of proven benefit, nihilism is not an effective overall treatment strategy.

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