The potential and perils of prognosticating persistent post-traumatic problems from a postpositivist perspective

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Abstract

BACKGROUND CONTEXT: Predicting recovery after traumatic neck pain has become an active area of research but is moving in several different directions with currently little consensus on the important outcomes to predict or relevant variables to predict them.

PURPOSE: This editorial explores the current state of prognostic (risk)-based tools or algorithms for predicting the likelihood of chronic problems after acute axial trauma, with a focus on traumatic neck pain (ie, whiplash-associated disorder).

STUDY DESIGN/SETTING: This paper has an editorial study design.

METHOD: This is a narrative commentary.

RESULTS: Prognostic efforts have value in guiding clinical decision-making and optimizing resource allocation to those at highest risk while minimizing iatrogenic disability for those at lower risk, but there are also several important caveats that should be observed when applying and interpreting the results of such tools. These include the biases associated with predicting outcomes based on findings from a single administration of a tool, inappropriate assumptions of causality, assumptions of linear relationships, and inability to consider the unique individual traits and contexts of patients that likely interact with clinical variables to influence the actual degree of risk they impart.

CONCLUSIONS: The paper concludes with a brief overview of trends that are likely to dramatically change the field, including creation of large clinical databases and big data analytics.   © 2018 Elsevier Inc. All rights reserved.

Keywords: Acute pain; Chronic pain; Clinical prediction rule; Injuries; Prognosis; Risk; Whiplash-associated disorder

Introduction

Physical rehabilitation is currently considered a frontline therapy for the management of post-traumatic spinal pain disorders such as whiplash-associated disorder (WAD). Primary goals of initiating good physical rehabilitation early are to facilitate recovery and to reduce or prevent the likelihood of transition to a state of chronic or persistent pain and disability. Key stakeholders in this process include the patients, eager to regain pre-event normalcy; the providers, who are judged based on patient outcomes; the payers (insurers), who have vested interest in seeing clients return to gainful income-earning employment; litigators, with a focus on securing appropriate recompense for losses in function or income-earning potential; and the broader society, who in many regions contribute part of their income to a tax or insurance base from which support for those who require care is drawn. As such, there are several interests with a stake in both the nature and the process of recovery.

Despite the anecdotal value of effective rehabilitation for acute spinal trauma, the empirical and epidemiologic lines of evidence are generally not supportive of the practice. Current best estimates indicate that 20%–50% of people who experience acute WAD will report some degree of persistent problem, such as pain, disability, or psychopathology several months later [1,2]. Disturbingly, the incidence and the burden of persistent post-traumatic problems do not seem to be reducing [3]. Equally troublesome for providers are recent large-scale clinical trials that report modest, if any, benefit of early targeted rehabilitation for WAD [4,5]. Taken together, one might wonder why interventions such as a course of physical therapy are offered at all in the acute stages of rehabilitation. As Lamb and colleagues [4] concluded after their MINT trial, "…usual consultations in emergency departments and a single follow-up physiotherapy advice session for persisting symptoms are recommended" (p. 555).

Fortunately, post-traumatic spinal pain continues to receive considerable attention in many academic and clinical institutions globally. Research groups are actively working to identify mechanisms explaining the acute-to-chronic transition [6–8] and the development and testing of screening protocols that can be administered in the acute stage of injury for more informed risk-stratified intervention to prevent chronicity. This line of work has enjoyed variable success, more so in low back pain [9] than in traumatic neck pain [10]. A recent systematic review by Kelly and colleagues [10] evaluated evidence supporting 15 such risk screening tools for neck pain and found that most had yet to undergo independent scrutiny and none had been evaluated for clinical impact. Together, the current pool of literature describes several attempts at describing and testing new risk-stratification tools for neck pain [11–14], many of which report good prognostic validity in initial development but considerably poorer performance when tested in independent cohorts [15]. The purpose of this editorial was to critically reflect on the direction of research in predicting patient outcomes, to provide potential explanations for the findings described so far, and to opine on reasonable directions for future research to arrive at clinically impactful risk-based practice for acute axial trauma.

The challenge of predicting the future

Most risk-stratification tools have been designed and tested under the assumption that they are applied at one time (eg, within days or weeks from injury) with the results then used to predict status after some period of time has elapsed (eg, 6 or 12 months). There is value in assigning a risk score to patients that allows clinical decision-making to move beyond clinician heuristics and intuition into the realm of quantitative observation and empirically supported predictions. Yet, most clinicians believe that they are reasonably accurate in identifying the "at-risk" patient without need for a standardized protocol [16], often through identifying early patterns of change over the initial weeks of treatment (ie, is the patient improving as expected or do they appear to be deviating from an expected trajectory?). Trajectories of recovery have been defined for WAD [17] that offer the ability to use trends in change rather than single point-in-time predictors to optimize prognostic estimates. The use of single point-in-time screening rather than trends may explain the inability of many protocols to consistently predict outcome.

So far, even the most rigorously designed clinical prediction algorithm for WAD provides a posterior probability of around 71% accuracy for predicting full recovery or nonrecovery [11]. This finding begs the question of how accurate clinician intuition would be at making similar predictions, but such questions have not yet been rigorously explored. Regardless, knowledge of the level of risk of an individual patient *should*, by virtue of having that knowledge, change the predicted trajectory. In other words, the very nature of evaluating and understanding risk changes that risk. Upon identifying the at-risk patient, astute clinicians should intervene appropriately, the negative outcome should not come to pass, and the clinical prediction rule may be deemed to have poor predictive validity as a result of its success in predicting outcomes. This paradox, where observing a phenomenon changes its nature by virtue of the observation (a sort of "Schrödinger cat" phenomenon), has yet to be fully explored by those in the field. However, it is only a problem inasmuch as another condition is met: that knowing the level of risk of chronicity leads to effective intervention strategies.

Identifying risk is one thing, doing something about it is another

Risk or prognosis screening tools are now reasonably accurate at identifying those at very high or very low risk of chronicity. These two categories, at least in WAD, account for around 35%–40% of the injured population [11]. This leaves 60%–65% in the "moderate" or "unknown" risk category for which the trends over the initial few weeks become even more valuable. However, the variables that consistently describe high risk of chronicity include things such as older age, female gender, lower educational attainment, higher initial ratings of pain intensity, higher self-reported disability, widespread mechanical hypersensitivity, cold hyperalgesia, and heightened reports of catastrophic beliefs about pain or intrusive reminders of the trauma [18,19]. Knowledge of risk is of only moderate value if this knowledge offers no clear directions for treatment decisions. As of this writing, there is no obvious way that gender, age, or educational attainment should influence treatment decisions. Pain and disability ratings are fairly blunt instruments for making treatment decisions, unless one endorses early and aggressive opioids to reduce pain that is probably not destined to be a widely adopted approach. Cold and mechanical hyperalgesia has been hypothesized to indicate dysfunctional central sensory or nociceptive processing that could lead to chronicity [20], but this information has yet to lead to effective treatment options. There is an interesting epistemic question that arises here: should effective interventions be identified *first* followed by