Novel Biomarker Use in the Evaluation of Facial Nerve Palsy

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ABSTRACT

Objectives: 1. To determine whether a novel biomarker (hyperphosphorylated neurofilament-heavy subunit) is able to be quantitated in patients with idiopathic facial nerve paralysis
2. To determine whether correlation exists between biomarker quantitation and clinical parameters in these patients

Study Design: Prospective clinical pilot study

Methods: From May 2006 to August of 2007, twelve patients that presented to the Emergency, Neurology, and Otolaryngology departments at a county hospital with acute onset unilateral facial paralysis were enrolled into the study. Serum samples at the time of presentation were obtained, and the following additional data was recorded and analyzed: age, sex, severity of paralysis at presentation, duration between time of onset of paralysis and presentation, side of paresis, associated comorbidities, time to recovery, and ancillary testing results. Data analysis was performed using Student’s t-test and analysis of variance; linear regression models and correlation coefficients were calculated using Microsoft Excel computer software.

RESULTS

There was no significant relationship between patient age (r²=0.20), sex (p=0.19), and side of paralysis (p=0.47) and biomarker level. The biomarker level increased with increasing facial paresis severity (p0.002, r²=0.17), and had a more pronounced relationship when patients were presented within the first 24 to 48 hours of paralysis (p=0.066, r²=0.59). There was no correlation between biomarker level and presentation time. Biomarker quantities were evaluated with respect to patient age, sex, associated comorbidities, other laboratory data, disease time course, and severity of paralysis as noted by the House-Brackmann score. Statistics were performed using the Student’s t-test and analysis of variance. Linear regression models and correlation coefficients were calculated using Microsoft Excel computer software.

The most common cause of facial nerve paralysis is Bell’s palsy. Seventy to eighty percent of patients recover completely within approximately three weeks. However, approximately one-sixth will ultimately have a poor outcome. These patients may be left with moderate or severe facial weakness, contracture, hemifacial weakness, or synkinesia.1-2 Several factors have been associated with poor prognosis including: age greater than sixty, hypertension, diabetes mellitus, dysgeusia, postauricular pain, rapid degeneration, complete facial weakness, or slow or only partial recovery by three weeks.1-2 However, there is no reliable method of determining early those who will not recover, either partially or fully.2,3 It would be beneficial to identify a diagnostic test with prognostic capabilities to identify the 12-25% of patients who will eventually present with an independent prognosticator, but it could be used in concert with the House-Brackmann system and/or ENOG results.

In an attempt to identify such a test, we assessed whether is was possible to quantify neurofilament proteins in patients with facial nerve paralysis and whether or not these correlates existed with respect to severity of paralysis or prognosis. Neurofilaments are the most abundant cytoskeletal element of large myelinated axons and are released into the extracellular fluid during axonal degeneration following axonal injury. The heavy subunit of neurofilaments is extensively phosphorylated, and the hyperphosphorylated form (pNF-H) is the only form found in axons and is more resistant to proteases than the other forms. Making this an ideal candidate marker of damage to neurons and axons.2,7 Shaw, at the University of Florida has developed an ELISA assay that is able to detect picogram quantities of pNF-H.1

The results from this study indicate that pNF-H is able to be quantitated in patients with facial nerve paralysis, and there is a positive correlation between this marker and the House-Brackmann score at presentation. However, this only held true within the first 48 hours after injury. Subsequently, the levels of pNF-H declined. There was no correlation between age (p>0.20), sex of the patient (p>0.19), latality of the paralysis (0.47), or House-Brackmann score at follow-up (p=0.0078). Thus, this biomarker does not show prognostic capabilities. Due to lack of patient data, no comment can be made regarding an association with ancillary testing.

This study suggests that neuron-specific biomarkers may be quantitated in patients with facial nerve paralysis. It is possible that other biomarkers may be able to provide more diagnostic or prognostic information, and additional studies should be pursued.

CONCLUSIONS

Hyperphosphorylated neurofilament-heavy subunit levels correlated with initial severity of facial paralysis, but were time-dependent. Despite its clinical utility in assessing neuronal injury in the CNS, pNF-H does not provide any prognostic information for patients with Bell’s palsy. Other neuronal biomarkers should be assessed for their clinical utility in evaluation and prognostication in patients with Bell’s palsy and possibly other forms of facial nerve paralysis.

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REFERENCES