CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38478

Project Title

UCH-L1 and s100B in Saliva as Novel Biomarkers for Severe Traumatic Brain Injury

Abstract

Objectives/Goals

Traumatic brain injury (TBI) damages cerebral cells and the annual cost to treat is $76.5 billion. CT scans are primarily used to determine extent of injury, yet are expensive, have risk of radiation, and take time to obtain. Current research supports serum biomarkers as early prognostic indicators of TBI. Saliva is a new noninvasive diagnostic medium; however, TBI biomarkers in saliva remain unexplored. We hypothesize that salivary s100B and UCH-L1 will be elevated in TBI.

Methods/Materials

Saliva was collected from 52 adult ER patients with TBI and 14 non-injured controls. ER doctors categorized TBI severity. Samples were processed using Aviva ELISA test kits. Spectral analysis was used to measure absorbance.

Results

In mild, moderate, and severe TBI, post-injury biomarker levels (pg/mL) were: mean s100B at 0-3 hrs: 57.1, 37.0, 80.9; at 4-18 hrs: 47.3, 24.0, 43.7; and at 19-48 hrs 55.2, 22.9, -0-. Mean UCH-L1 at 0-3 hrs: 54.6, 54.7, 71.1; at 4-18 hrs: 54.6, 33.5, 44.8; and at 19-48 hrs: 47.5, 37.2, -0-. No data at 19-48 hours post severe injury, as no severe TBI presented so late. Both biomarkers differentiated severe from mild and moderate TBI.

Conclusions/Discussion

This is the first study to show increased s100B and UCH-L1 levels in saliva in severe TBI in the first 3 hours after injury. Peak elevation occurring in the first 3 hours was followed by a rapid decline, which underscores the need to test soon after trauma. By demonstrating higher levels of UCH-L1 in saliva over a larger sample size than in a published serum study, we propose that saliva is a better alternative to blood for detection of this marker in TBI. Last year we demonstrated salivary Occludin could differentiate mild TBI from moderate/severe TBI. This year we found UCH-L1 and s100B can separate severe from mild/moderate TBI. By combining these two tests, we believe a multiplex test can be fitted into a mouth guard that estimates extent of injury even before medical personnel see the patient, thus saving time, reducing cost and exposure to radiation. Only one month ago, the FDA approved the use of serum UCH-L1 for concussion. However, saliva is easier to obtain than blood, saliva tests for biomarkers can be repeated more often and at the site of trauma, and using biomarkers may also help reduce overuse of CT scans.

Summary Statement

We showed that salivary s100B and UCH-L1 can identify severe TBI, and when combined with last year's results showing how Occludin can identify mild TBI, we could create a multiplex to stratify severity of TBI and reduce overuse of CT scans.

Help Received

After 2017 project on salivary Occludin in TBI, we met with Dr. Feldman (Good Samaritan ER) to increase sample size, worked with Dr. Podoly (BioCube) to identify new salivary biomarkers, and stratified patients into 3 time periods after trauma to assess effect on biomarker concentrations.