Sigma Theta Tau International’s 29th International Nursing Research Congress

Use of Plasma Biomarkers to Test Frailty in Geriatric Trauma Patients

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Purpose:

Oxidative stress (OS) contributes to cellular deterioration, resulting in decreases in physiological reserve. Imbalance of oxidative stress pathways lead to damage and drive the aging process and frailty. Study goals were to determine if a new plasma biomarker of oxidative stress is related to: 1) oxidation reduction status in patients who have experienced traumatic injury as well as healthy community dwellers, 2) outcomes of patients who have experienced trauma, 3) frailty measured by established frailty scales in healthy community dwellers.

Methods:

This prospective study included 1) trauma patient’s ≥65 years of age admitted to a suburban Level 1 trauma center between 6/12/14-12/30/14 and 2) age and gender matched healthy, community-dwelling volunteers. Plasma samples (40μL) were tested in duplicate for capacity ORP (cORP, uC; antioxidant reserve), and static ORP (sORP, mV; the current state of OS). Frailty assessments were performed in healthy participants using established frailty scales. ORP measurements were analyzed using correlation analyses. Univariate analysis was used to analyze cORP and sORP for differences by gender and by the presence/absence of the following variables in both the injured and healthy control populations: current smoker, pre-injury diabetes mellitus (DM), statin use, vitamin use, and any alcohol consumption.

Results:

186 subjects were included in the study (n=93 for both groups). Nearly half of the trauma patients (44%) were admitted due to a Traumatic Brain Injury; Injury Severity Scores were low (median [interquartile range] = 9.0 [5-13]). In the trauma population, cORP values were significantly lower in patients with Diabetes (p<0.05) and in patients that smoked (p<0.01). Similar results were found in the healthy group for smoking and diabetes (p<0.05). In healthy participants a lack of vitamin use was also related to lower cORP values (p<0.05), however there were no differences in sORP in the healthy volunteers. There were no significant differences based on gender, statin or alcohol use for either group. Significant correlation was found for both sORP and cORP with CSHA Clinical Frailty Scale in the healthy group.

Conclusion:

Findings suggest that the variables of smoking and diabetes are contributory to frailty trajectory. Data suggest the capacity to tolerate oxidative stress, measured by cORP, is lower in aged individuals that smoke or are diabetic and contributes to frailty as a result of oxidative damage. These frailty markers may be used in the emergent and post emergent injury phases of care. The finding that there is an increase in the sORP and a decrease in cORP in these patient populations puts them at higher risk suggests a progressive loss of redundancy in physiological systems in response to oxidative stress.

Title:

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Keywords:
Acute Injury, Biomarker and Frailty

References:


Abstract Summary:
Providing care to injured elder adults present challenges in the emergent injury phase. This study of both injured and healthy volunteers demonstrated that an easy to use frailty scale, used in combination with a plasma biomarker can be incorporated into for clinical protocols elderly trauma patients.

Content Outline:
I. Background
   A. Elder trauma patients volume growing
      1. Increase in aging world population
      2. Impact of early frailty recognition
   B. Frailty assessments tools-Four Current approaches discussion of Pro's and Con's of each scale
      1. Fried Frailty Phenotype
      2. Frailty Index
      3. CSHA Frailty Scale
      4. Frail Scale
   C. Literature review
      1. Identification of Key Trauma and Frailty Articles that support this study's hypothesis
   D. Theories of aging
      1. Biological Pathways of Aging and Frailty
      2. Oxidative Stress Pathways of Aging and Frailty

II. Oxidative Stress
   A. Current measures for evaluating/Biomarkers in Clinical Practice Settings
   B. Oxidative Reduction Potential (ORP) is the definition of new innovative biomarkers that can be tested at the bedside which measure oxidant and anti-oxidant levels to assess oxidative damage in the macromolecules
      1. Static ORP reflects the total balance or tendency of the system to either donate of take up electrons
      2. Capacity ORP is a measure of anti-oxidant reserve in the body
      3. Discussion of ORP results providing a view of the redox status of a patient

III. Study Methodology/Results-explanation and pictorial description of the oxidation reduction potential test
   A. Oxidative Burden variables
      1. Use of Statins
      2. Use of Alcohol
      3. Use of Vitamins
      4. Use of Tobacco
      5. Diabetes
   B. Frailty scale correlation with plasma biomarkers
   C. Implication for practice
      1. ORP Testing incorporated into injury prevention efforts for high-risk patients
      2. Use in determining trauma trajectory after emergent trauma admission
      3. Cogent examples of how best to identify frailty in the clinical setting at time of injury
   D. Future Research
      1. Opportunities in frailty identification in the pre-injury state in vulnerable populations
      2. Longitudinal studies for tracking healthy populations by measuring ORP to determine when aging may begin

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**Professional Experience:** Oct. 2009-Present Trauma Program Director, St. Anthony Hospital, Lakewood, CO., Mountains and North Denver Operating Group - Overall trauma program responsibility which includes operations, clinical practice, budgetary and regulatory compliance for Level I Trauma Center and responsibility for Trauma Programs at three Level III facilities and two Level IV facilities. Aug. 2005-July 2009 Trauma Program Manager, St. Anthony Central Hospital, Denver, CO - Overall trauma program responsibility which includes operations, clinical practice, budgetary and regulatory compliance for Level I Trauma Center. Nov. 1996-Aug. 2005 Trauma Nurse Clinical Specialist, St. Anthony Central Hospital, Denver, CO – Provides collaborative, multidisciplinary care of patients on Trauma Service as expert practitioner, educator, consultant, researcher and program manager.

**Author Summary:** Dr. Pamela Bourg, PhD, RN, TCRN, FAEN is the director of the Centura Trauma Programs for the Mountain and North Denver Operating Group in Colorado. Her career reflects an integration of clinical practice, education and research that has influenced colleagues and patients. Through her research, writing, and editorial work, she has substantially contributed to emergency nursing and trauma nursing. Pam has won nursing awards both regionally and nationally for her contribution to emergency and trauma nursing.