An Unconventional Approach to Reducing Retinal Degeneration After Traumatic Ocular Injury

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**Institution Receiving Award:** NEW YORK, STATE UNIVERSITY OF, DOWNSTATE MEDICAL CENTER  
**Program:** VRP  
**Proposal Number:** MR130448  
**Award Number:** W81XWH-15-1-0138  
**Funding Mechanism:** Vision Research Program - Hypothesis Development Award  
**Partnering Awards:**  
**Award Amount:** $249,993.00

**PUBLIC ABSTRACT**

Objectives and Rationale: There has been a sharp rise in ocular injuries in our military due to blasts from Improvised Explosive Devices, or IEDs. According to research by Dr. Kevin Frick at John Hopkins, from 2000-2010, the total incident cost of eye injuries in the military each year has been $2.282 billion. The objective of this research is to determine if blood flow regulating drugs, not currently used to treat traumatic ocular injury, may be used to lessen retinal degeneration after injury by enhancing oxygen distribution within the retina as well as increasing blood flow within the eye. Our previous research in preclinical age-related macular degeneration (AMD), which is a common disease and a leading cause of vision loss among people age 50 and older, has shown that an orally administered, clinically available blood flow regulating drug resulted in a 40% decrease in cell death. These results have supported our novel blood vessel imaging techniques and have led us to a number of dramatic findings regarding blood flow and neurodegeneration within the eye, particularly after injury. We anticipate that these new discoveries will lead to a better understanding of how to treat injuries and diseases of the eyes. Most importantly, we believe this research will lead to better and quicker treatment regimens for traumatic ocular injury with more effective clinical outcomes.

Impact of the Research: Eye injury, especially resulting from a blast from IEDs or vision impairment from traumatic brain injury, has been clinically thought to be an issue of blood flow in the vessels found in the retina. Since validating blood flow in a live animal is very challenging, this outcome has not been observed directly - until now. Our imaging techniques have accurately determined blood flow, found blood flow abnormalities, and also measured the ameliorative effects of blood flow drugs preventing dysfunction. This research will have far-reaching impacts on treatment of military personnel in the field as well as to the population as a whole. The benefits include earlier treatment to increase oxygen and blood flow to damaged portions of the eye, decreasing cell death, and improving long-term outcomes. This therapy would be administered jointly with other currently used clinical practices regarding eye injuries. Risks associated with clinical application of this research are minimal since existing blood flow-enhancing drugs have been used for decades and are approved by the Food and Drug Administration.

Projected Timeline: We propose to complete this research project in 21 months. Dr. Matthew Harper at the Department of Veterans Affairs Center for the Prevention and Treatment of Visual Loss at the University of Iowa will provide test subjects with ocular injury. Once this is completed and, if the results of our aims are successful, we will fast-track validation of the preclinical research using human patients.

Military Benefit: "Although the exposed surface of the eyeball constitutes only 0.1% of the frontal body silhouette, the incidence of ocular injuries in warfare is about 20 to 50 times higher than could be expected," according to Giorgio Romani, MD, head of the ophthalmology unit at the Military Hospital in Rome. "Improved munitions, which create increasingly smaller fragments, and also nonconventional or..."
unknown munitions such as those used in terrorists' explosions, have multiplied the number of blast injuries and fragment injuries in the eye apparatus,” said Massimo Cantarini, MD, senior consultant of ophthalmology and head of the neurosensory department of the Military Hospital in Rome. The results from this research could prove out an entirely new treatment regime for military members that will improve patient care and outcomes and decrease costs associated with traumatic ocular injury.