Author's response to reviews

Title: Ophthalmodynamometry for ICP prediction and pilot field test on Mt. Everest

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Dr. Melissa Norton, MD
Editor-in Chief
BMC Neurology

Dear Dr Norton:

We are pleased to submit our work titled, 'Ophthalmodynamometry for ICP prediction and pilot field test on Mt. Everest', for consideration to be published in the BMC Neurology. The authors are: Henry Querfurth, Philip Lieberman, Steve Arms, Steve Mundell, Michael Bennett, and Craig van Horne. Our paper fulfills criteria for an original research article and also contains innovative methodology. It describes in technical detail the clinical validation of our venous ophthalmodynamometer (vODM) to make non-invasive measurements of intracranial pressure and then provides proof-of-principle that such measurements can be made in the field by determining the physiologic adaptation of brain pressure to hypobaric hypoxia.

First, we undertook to validate the method and vODM device through statistical approaches. Then, we calibrated the device output against neurosurgical patients in the intensive care unit, 'blinded' to the actual pressures. Next, measurements were taken on climbers at various elevations on the approach to basecamp and at Camp 2 on Mt Everest. Importantly, this is the first demonstration of the vODM technique at high altitude. Second, we provide novel absolute values of estimated ICP, in mmHg, at these altitudes. To our knowledge, no other device or method has been able to accomplish this.

Our non-invasive results show a strong correlation with actual ICPs obtained in ICU patients. The vODM methodology to predict ICP was then used to show a
physiological rise in ICP (mmHg) with ascent to 6550 meters. Moreover, there was no correlation of ICP with acute mountain sickness (AMS) symptoms. These findings agree with some, but not all, recently published results from a study using measurements of optic nerve sheath diameter, a very different technique providing only relative units. In our paper’s discussion section, we make comparisons between all known techniques to assess ICP and review the data based on brain MRI and cerebrovascular Doppler to support our conclusions.

Since adaptive ICP change is an important variable in the pathophysiology of headache and cognitive symptoms at high altitude and non-invasive measurement technology has broader application in neurology practice, this article should have interest to your readership.

The following reviewers can be recommended:

1) Dr. Geoffery Tabin M.D. Ophthalmology, U. of Utah <Geoffrey.Tabin@hsc.utah.edu>
2) Dr. Larry Chin MD, Dept. of Neurosurgery, Boston University <Lawrence.Chin@bmc.org>
3) Dr. Allan Cymerman PhD, USARIEM, Natick, MA <allen.cymerman@us.army.mil>
4) Dr Thomas Hedges, Dept of Neuroophthalmology, Tufts Medical Center, Boston <thedges@tuftsmedical center.org>
5) Dr. William Morgan, Lyons Eye Institute, Glaucoma Center. Nedlands, Univ of. West Australia <whmorgan@cyllewe.uwa.edu.au>
6) Dr. Bob Friedlander, Dept of Neurosurgery, Brigham and Women's Hospital, Boston <bfriedlander@partners.org>

We acknowledge this is a competitive field of research and that the literature holds contentious findings. Therefore, we ask the following teams of co-authors not be asked to review our work:

1) Dr. M. Blaivas, (Med College of Georgia, Augusta)
2) Dr. R. Firsching and W. Behrens-Baumann W. and M. Motschman, (Germany)
3) Dr. Peter.H. Hackett
4) Dr. A.I. Sutherland and Dr. Robert C. Roach, (Univ. of Colorado, Denver)
5) Dr. Michael Grocott and Dr. Mark H. Wilson (Center Aviation, Altitude, Space and Extreme Environ Med, University College London, UK)

Thank you and sincerely yours,

Henry Querfurth MD PhD
Associate Professor Neurology