TBI, GBM, and BtO2: a CNST grab-bag summer

Patrick Georgoff
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Projects:

1. Meta-analysis of outcomes of traumatic brain injury, *complete* (mentor: Dr. Sherman Stein, Department of Neurosurgery)

2. Quality of life in patients with brain tumors; *ongoing* (mentor: Dr. Sherman Stein, Department of Neurosurgery)

3. Low brain tissue oxygen after traumatic brain injury: interventions and outcomes; *ongoing* (mentor: Dr. Jose Pascual, Department of Trauma and Critical Care)
TBI Outcome Meta Analysis;
late 1800’s-today, 207 case series (N=140,000+ cases)

• “Geographic Variation in Outcomes from Severe Traumatic Brain Injury”
  *submitted to J Neurotrauma

• “Aggressive Monitoring and Treatment Improve Outcomes in Severe Traumatic Brain Injury”  *accepted by J Neurosurgery

• “150 Years of Treating Severe Traumatic Brain Injury: A Systematic Review of Progress”  *submitted to J Trauma
Mortality rates of low-intensity treatment patients compared to that of high-intensity treatment patients. Pooled means and 95% confidence intervals of the two meta-regressions are superimposed. The difference in mean mortality falls from 12.5% in the 1970’s to 11.5% in the 2000’s.
Meta-regression of favorable outcome rates (GOS scores of 4-5), plotted against time. The scattergram of the case series is plotted, along with the pooled mean rates and the 95% confidence interval. High-intensity treatment patients are shown in black, low-intensity treatment patients in gray. The slight upward inclination (1% per decade) is not statistically significant.
Comparative mortality rates by geo-economic status. Pictured are the rates over time of the US, other developed (high- and moderate income) countries and developing (low income) countries. The solid lines represent the fitted regression line for each category, the gray areas are the 95% confidence intervals.
Brain Tumor QOL

• To date, there are no comprehensive glioblastoma multiforme (GBM) QOL analyses
• QOL in patients w/ GBM changes rapidly
• Using three validated QOL instruments we are following patient progress on a monthly basis, using proxies when necessary
• Using quality-adjusted life years (QALYs), a cumulative measure of QOL, we will estimate a summary value of QOL over the entire course of treatment
Brain tissue oxygenation

• Cerebral swelling following traumatic brain injury (TBI) is common and can lead to increased intracranial pressure (ICP). This may in turn result in reductions of brain tissue oxygenation (BtO2)
• Brain tissue hypoxia has been associated with increased mortality in TBI even in the setting of normal intracranial pressure (ICP) and cerebral perfusion pressure (CPP)
• BtO2 measurement in patients with intracranial pressure monitors using the LICOX monitoring system is the standard of care at the Hospital of the University of Pennsylvania since 2001
Do current treatments work?

• It remains unclear what management strategies to use in order to correct \textit{isolated} reductions in BtO2.
• Clinical approaches vary: increasing inspired oxygen concentration (FiO2), PRBC transfusion, sedation, fluid challenges, osmotherapy, and pressor/inotrope use.
• We aim to evaluate the effectiveness of the various BtO2-correcting interventions used at HUP and establish a bedside management algorithm for TBI care providers.
• Design: retrospective chart review of all closed TBI patients who underwent BtO2 monitoring at HUP since 2002 (n=237).
Why is this study special?

- When complete, this study will include the single largest data set of patients undergoing BtO2 monitoring.
- While standard of care at HUP, BtO2 monitoring is a relatively new technology that has yet to be adopted on a large scale (note, the Brain Trauma Foundation included BtO2 monitoring in their 2007 update of TBI care).
- We know BtO2 monitoring is safe, accurate, and can predict mortality but we don’t know how to treat it. This study has the potential to specifically address this serious limitation.
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• Dr. Jose Pascual
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