

Learning for Life Week 3 Summary 10-10-18

Topic: Treatment for Brain Disease

Speakers: Daniel Brat MD, PhD; Joshua Goldstein MD; Joshua Rosenow MD

Today's speakers led us from the early discovery of brain tumors and their classification, to the clinical systems that support the effective treatment of stroke in pediatric patients, and finally, to the use of novel neurosurgical treatments with widespread application for a variety of diseases. Again, our speakers addressed the importance of collaboration across the departments at Northwestern and the utilization of machine-learning as critical to the advanced care that Northwestern provides for all patients.

The initial focus of the morning was on *diagnosis*, as Dan described the history of the World Health Organization's (WHO) classification of brain tumors, specifically diffuse gliomas. Microscopic examination of tumor tissue samples led to classification of tumors (eg. astrocytomas or glioblastomas) based on the characteristic appearance of the tissues under the microscope. The effectiveness of this tumor classification system was limited, because pathologists often identified the same tissue sample in different ways, and there was no consistent clinical behavior in tumors classified as particular subtypes or grades. The latter was particularly important because an accurate classification of tumor subtype and grade dictates treatment. When genomic analysis identified a series of mutations in glioma brain tumors, allowing them to be classified according to whether or not they displayed particular genetic mutations, their behavior became much more consistent. Now the molecular profile of a tumor could predict its prevalence in certain age groups and the patient's likely outcome. Dan's research utilizes artificial intelligence or machine-learning to categorize the massive volumes of data that arise from the detailed molecular profile of a tumor and its histologic appearance. This work has transformed the clinical utility of tumor classification.

We moved from the "bench to the bedside," as we learned about Lurie Childrens' neuro critical care unit and the diagnosis and treatment of pediatric stroke. Josh discussed a number of cases to illustrate the clinical challenges of making the correct diagnosis and implementing effective treatment, when a young patient comes to the emergency department with neurologic symptoms. He stressed the importance of rapid diagnosis and initiation of "brain saving" treatment, utilizing a series of brain MRIs and angiograms. The implementation of a "Time is Brain" clinical guideline has enabled the stroke team at Lurie Childrens' to reduce the time between ER presentation to treatment by 2.4 hours -- from 3.7 hours to 79 minutes. A wonderful video of a 4 yr old young boy running around an exam room illustrated the success of this multidisciplinary approach in caring for these vulnerable patients.

Advances in technology were highlighted next, when Josh described his use of deep brain stimulation to improve the lives of patients with a variety of neurological and psychiatric conditions. For today's talk, he focused on patients with Parkinson's disease and Essential Tremor and explained how the implantation of increasingly sophisticated electrodes into the patient's brain at sites that control movement transforms the lives and conditions of patients who have difficulty controlling symptoms with medications. We watched a video demonstration of two patients who were unable to walk, move,

and write when their deep stimulator was turned off, and then saw the amazing difference when it was turned back on. The patients who had severe Parkinson's and Essential Tremor had nearly normal function with the stimulation. The video demonstration highlighted the extraordinary work that is being done with this technology. Josh ended his presentation with a look to the future—brain stimulators that also can sense and respond to neurotransmitters and adjust levels of stimulation based upon these stimulants.

For a video of the work that Josh Rosenow does please take a look at:

<https://www.facebook.com/northwesternmedicine/videos/551411645315598/>

Take Home Points:

1. Genetics has transformed the classification of brain tumors, allowing tumors to be recognized by molecular profiles rather than their appearance under the microscope. This has allowed for more clinically meaningful diagnoses that can drive treatment decisions
2. Careful diagnostic evaluation, together with excellent clinical skills, imaging and adherence to guidelines has enhanced the care of children with stroke and improved their long-term outcomes.
3. Utilization of advanced technology to produce electrodes that can stimulate the brain has changed the lives of patients with many neurological diseases, including motor disorders and psychiatric conditions like OCD. The potential for further development and application to other conditions is tremendous.