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Fellows spur the creation of Canada’s first “Epilepsy Brain Bank” focused exclusively on adult epilepsy research

Canada has joined the United States, Germany and other European countries in establishing a “brain bank” to study the causes of refractory epilepsy in adults, thanks to a pair of Saskatoon physicians.

“In other countries, the concept of a brain bank is more advanced,” said **José Tellez-Zenteno, MD, PhD, FRCPC**, a staff neurologist and founder of the Saskatchewan Epilepsy Program at the Royal University Hospital in Saskatoon, and professor in the Division of Neurology at the University of Saskatchewan.

“When we saw that there was no dedicated epilepsy brain bank for adult patients in Canada, our inspiration was to create the first one.”

Brain bank hopes to accelerate epilepsy research

Approximately 10,000 people in Saskatchewan (or one per cent of the population) have epilepsy. Nationwide that number jumps to 300,000. In about 30-40 per cent of cases, medication is ineffective for controlling the condition. This can make simple tasks like cooking or driving a challenge, since a seizure can come on with little warning putting the patient or others at risk. A portion of these patients could be potential candidates for epilepsy surgery.

Dr. Tellez-Zenteno and **Farzad Moien-Afshari, MD, PhD, FRCPC**, who is an assistant professor of Neurology and Pharmacology at the University of Saskatchewan, came up with the idea to create a brain bank of samples from patients of their epilepsy clinic who undergo epilepsy surgery, something that distinguishes their project from some of the bigger, central banks that pool samples from both local and international sources.

“Our interest is in trying to get the samples from living patients.

These are patients with refractory epilepsy with partial onset seizures that we are investigating using different investigations, including Video-EEG telemetry, PET scans, MRI and fMRI,” they explained.

Having the results of those clinical tests on file enhances the research value of the donated tissue samples. The team hopes that these samples will advance and accelerate research on adults living with temporal lobe epilepsy, the most common type of epilepsy in adults and where medication is ineffective in about 70 per cent of cases.

Samples are sourced from consenting surgical candidates

Surgical interventions are an alternative for a very select group of patients who do not respond to medication and who meet certain criteria, such as a high frequency of seizures (2-3 per month) that have persisted for a minimum of 24 months.

The most common form of surgery is a brain resection procedure that is highly effective in controlling seizures by removing the part of the brain where the seizures originate — a sample usually no bigger than the size of a golf ball.

Patients of the Saskatchewan Epilepsy Program who qualify and choose surgery are made aware of the brain bank and asked to consider donating their sample for study.



Dr. Lizbeth Hernandez shows a temporal lobe sample from one of the resections.



On the day of the surgery of patients who provide consent, the extracted tissue is taken swiftly and directly from the operating room to the pathologist who selects his/her diagnostic sample; the rest of the sample, rather than be incinerated, is carefully frozen in liquid nitrogen and stored at -80 degrees Celsius in the brain bank, which is housed at the University of Saskatchewan.

"So far, we have had a very good response. We have five samples now; only two patients whom we approached didn't want to donate," said Dr. Tellez-Zenteno.

The doctors shared that the team's goal is to collect about 10 samples per year and they are hopeful that as word of the bank and its research benefits spreads, additional patients will contribute.

"More than 90 per cent of existing epilepsy research is on non-human tissue, like rats, rabbits, mice. The possibility to use human tissue is very important because whatever you find you can extrapolate to humans, much easier than findings from a rat."

Sophisticated research could unlock new treatment targets

This project took off thanks to seed funding from the Saskatchewan Health Research Foundation and the University of Saskatchewan, which supported the creation of the bank and establishment of an interdisciplinary Saskatchewan Epilepsy Research Initiative Team. With a handful of samples now collected, the research component of this project is ready to get underway.

"It's possible to use proteomics, genomics, molecular biology, and immunohistochemistry to compare the tissue of epileptic patients who didn't respond to medication with normal tissue from patients who don't have epilepsy," said Dr. Moien-Afshari. "We will search for the common abnormal pathways shared amongst the brain samples of patients with refractory partial seizures. We expect the abnormalities to exist in neurotransmitter receptors or ion channels. The shared abnormal pathways can be further analyzed to identify potential targets for developing new antiepileptic medications."

The team hopes to eventually publish their findings and that their research will contribute to scholarship on the characteristics and regions of the brain that may be more prone to seizures, with an aim to inform new treatment targets and medications for patients.

For the time being, the bank is only collecting samples from adult patients in Saskatchewan but Dr. Tellez-Zenteno and Dr. Moien-Afshari do not exclude the possibility of eventually gathering a broader sampling, although they think it is more likely that more province-specific banks will be developed.

Dr. Tellez-Zenteno shared, "It's new and we're learning, but it's very promising work. I think that in the future, other epilepsy centres may be interested in starting their own projects and working on their own brain banks."

Correction: An earlier version of this article incorrectly stated in the title that the Saskatoon Epilepsy Brain Bank was the first brain bank in Canada; in actuality, it is one of the first and the first to focus exclusively on adult epilepsy research.

Dr. Mark Hiken analyzes a sample from a resection to select the sample that will be used for histopathological analysis. The rest will be saved in the bank.



The special refrigerator that is used to save the brain tissue samples.



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