

# Neurodiagnostic Technologists

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### Introduction

We sit, we stand, we push, we pull and sometimes we crawl on the floor. We untangle knots of wires that can make your eyes cross and your fingers numb then ensure all are plugged into the correct slots. We drive our mini AV systems through the corridors of the hospital looking more like someone from the set of a Star Trek movie. We are Neurodiagnostic Technologists and we record tiny electrical signals from the most amazing Mother Board on Earth, the human brain and all its intricate connections.

Neurodiagnostics is a field encompassing several medical tests which record low voltage bioelectric signals from the Central and Peripheral Nervous Systems (CNS, PNS). Technologists use sophisticated equipment to record and evaluate electrical activity generated by the brain and nerves, and electrical activity resulting from stimulation of sensory and motor pathways. These tests aide in the diagnosis, prognosis and treatment of patients with a myriad of symptoms and include Neonatal, Pediatric and Adult Electroencephalogram (EEG), Electromyogram (EMG), Nerve Conduction Studies (NCS), Evoked Potentials (EP) and Intraoperative Monitoring (IOM).

### Requirements

- Technologists need a wide range of skills which require us to:
- interact with and reassure the patient, family and caregivers
  - obtain relevant history pertaining to the patient's clinical symptoms
  - have good knowledge of all Neurological symptoms, conditions and diseases
  - have good knowledge of Neuroanatomy, Nerve and Muscle Anatomy and Physiology
  - measure, mark and apply electrodes at predetermined sites of the head and body
  - troubleshoot equipment and ensure the recording system is intact
  - operate specialized equipment and evaluate data as acquired
  - identify, eliminate or monitor physiological, electrical and environmental artifacts
  - observe and instruct the patient to maintain a high quality recording
  - recognize normal and abnormal patterns
  - alert physicians to any conditions which require immediate medical intervention

*Pattern Recognition is a highly developed skill that few individuals are accomplished in. Even most physicians are not familiar with all the complex patterns we must understand to do our jobs well!*

### EEG

We see patients for many reasons but the main purpose of an EEG is to detect seizures. When neurons send out the wrong signals in the brain, seizures may occur. They can arise at any age, even in utero and can happen to anyone. They can be caused by genetic anomalies, structural abnormalities, (for example those resulting from head injuries, strokes, tumors, hypoxia, etc.) or happen in association with any type of metabolic derangement. They can be influenced by drugs, alcohol, stress and sleep deprivation.

The Technologist must be familiar with all seizure types and their array of symptoms. We have to know which area of the brain corresponds to a patient's symptoms. We have to know specific EEG patterns, how they relate to the symptoms and how to best display these patterns. We must know what Activation Procedures will likely provoke a seizure and which patients we should perform these procedures on. If we capture a seizure we must ensure patient safety, response test the person to determine what impairments they suffer during their Seizure and document our observations.

One example we encounter daily is a pattern in the alpha frequency range of 8-13Hz. It is a sinusoidal rhythm in the posterior head region, seen maximally in the occipitals and known as the Posterior Dominant Rhythm. It is the hallmark pattern of a normal awake EEG and should be reactive to eye opening and closing. This is just one of hundreds of patterns and situations we need to understand to be good Technologists.

A patient diagnosed with seizures may lose their driver's license and may need one or more EEGs to show their seizures are under control. Imagine the truck driver, taxi driver or delivery person whose lives are on hold until an EEG confirms they are safe to resume working.

In one of our most critical situations, a patient may present with unexplained loss of consciousness (LOC). If their clinical presentation and other tests do not explain their LOC, an EEG may reveal the patient is in Non Convulsive Status Epilepticus. This is a life threatening condition and must be treated immediately. In this case an EEG is the **ONLY** way to know if the patient is having ongoing seizure activity.

Once diagnosed, will continue to monitor the patient to ensure treatment is working. This involves days, sometimes weeks of intensive monitoring. Once the medical team is ready to lift treatment, we also monitor this process to ensure the patient does not begin having seizures again.

## EMG/NCS

Patients are referred to the EMG lab for signs or symptoms indicating a nerve or muscle disorder. These symptoms may include tingling, numbness, weakness, muscle pain or cramping. EMG/NCS results are needed to help diagnose or rule out a number of conditions.

We see a broad range of these in our lab, including muscular dystrophies, inflammatory muscle diseases, neuromuscular junction disorders and neuropathic disorders. We also see traumatic nerve injuries ranging from a herniated disc of the spine to a gunshot wound of the leg. Diagnosis may include Carpal Tunnel, a fairly common syndrome in this computer driven era, to debilitating diseases that affect the motor neurons in the brain and spinal cord. A well known example to baseball fans is Amyotrophic Lateral Sclerosis, also known as Lou Gehrig's disease.

The technologist's role in the EMG lab is to perform Nerve Conduction Studies. These are done by placing electrodes on the skin and stimulating nerves through electrical impulses. NCS are broken down into two categories, motor and sensory. NCS allows us to accurately localize focal lesions or detect generalized disease processes along accessible portions of the Peripheral Nervous System (PNS).

The EMG Technologist must have an intricate knowledge of the PNS, including all nerves and the muscles they innervate. We must understand both dermatomes, the sensory distribution of these nerves, and myotomes, the motor distribution. We must understand all neuromuscular conditions that may present to the EMG lab and be able to obtain history relevant to these disorders.

EMG is performed by the Neurologist who will insert a recording electrode, a small needle, into the muscle and record the electrical activity from the muscle. Once the needle is inserted the Neurologist will show the patient how to move to activate their muscle so we are able to record its electrical potential.

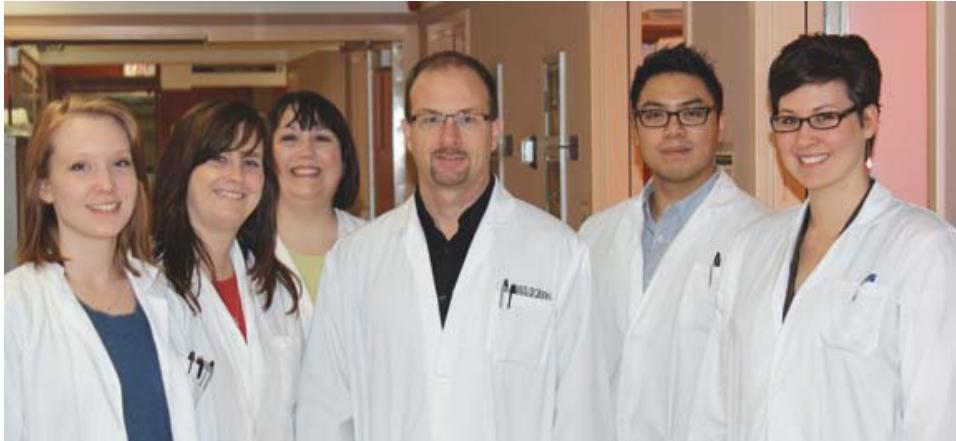
## HSC Adult Lab: Additional Services

### Telephone Transmission EEG

We provide remote EEG recordings in Thompson and The Pas using specialized equipment in our lab to liaise with northern technicians cross trained in electrode application. This allows patients the opportunity to have this service in their own community and to avoid long and costly trips away from their family.

### Ambulatory EEG

For patients with possible Epilepsy we may provide Ambulatory EEG monitoring. With a generous donation from



L to R: Ashton Liban, Jodi Kent, Melinda Becker, Darryl Hay, Michael David, Kara Gillis, missing from photo is Joanne Nikkel

**Mr. James Cook**, the lab was able to purchase two ambulatory systems. Patients can return to the comfort of their home each day while their brain waves are monitored 24/7. At the same time we save the health care system thousands of dollars by avoiding costly hospital admissions. A win win situation for patients and taxpayers alike!

### Epilepsy Monitoring Unit

We have a 2 patient Epilepsy Monitoring Unit on GD2 that is hard wired to capture 24 hour EEG Video and Audio recording. The goal here is to help patients with Intractable Epilepsy. Their treatment may be altered or the monitoring may be part of their work up for epilepsy surgery. The surgery may help reduce or even stop a patient's seizures. We may help change the way a patient is able to live the rest of their life; how amazing is that?

### WADA and Ictal SPECT

Epilepsy patients may also require Ictal SPECT or WADA testing as part of their surgical workup. Here we team up with Neurology, Neuropsychology, Radiology and Neurosurgery staff to administer highly specialized tests. Coordinating all these departments requires a bit of magic.

### Intraoperative Monitoring

For candidates who have a surgical resection to manage their seizures, we are in the OR to help guide the Neurosurgeon while he places electrodes into the patient's brain. We continue to monitor the patient in the Neurosurgery step-down unit on GA5, recording from these specialized electrodes until enough seizures are captured to proceed with the surgical resection. Did I mention this can be a life changing experience?

### Education

Most individuals entering Neurodiagnostics have some post secondary education. Technologists are often trained in EEG initially and then receive additional training in other areas. We must obtain a registration in our discipline of choice.

The EEG program is 2-3 years long studying under a Hospital based program or a College diploma certificate. The National exam is governed by a Board (CBRET) with members from across Canada. There is a Written Exam after 1-2 years of training. Then we must perform 500 recordings to be eligible for the three part Oral Practical Exam. The exam is held once a year at a National site governed by CBRET. Once we have passed all portions of the exam, we become a Registered Electroencephalogram Technologist (RET).

The EMG/NCS Registration is also governed by a National Board (BRETC). An individual must complete a variety of unassisted Nerve Conduction studies on 1000 patients. The exam is administered in two parts, with a Written and a Practical component. The Practical Exam is a 1 hour minimum assessment of the Technologist's ability to carry out a Nerve Conduction Study. Once successfully completing the exam we become a Registered Electromyography Technologist (REMG T).

### **Neurodiagnostic Technologists in Manitoba**

So now that you have an idea of what we do, could you guess how many Neurodiagnostic Technologists there are in Manitoba? Currently Children's Hospital has 4 RET's, HSC Adults has 5 RET's, 1 is a cross trained R EMG T, there are 2 student EEG Technicians and we are providing a Practicum site to a third Neurodiagnostic student from a diploma program in Ottawa. The 2 RET's at SBGH have recently retired but are taking shifts until their 1 student EEG Technician can become registered (this still leaves the lab short one Technologist). At the time of this article SBGH has been unable to fill their recently vacated positions. There is 1 RET at Deer Lodge and 1 RET in Brandon. Some of these sites provide on call services.

That's a grand total of 13 Registered Technologists and 3 student EEG Technicians who do EEG, EMG, NCS, EP and some IOM. In fact, there are fewer Technologists now than when our most senior Technologist was a student, and many of the services we provide today were not being offered.

### **HSC Adult Neurodiagnostic Lab**

At the HSC Adult lab we provide outpatient and inpatient services in both EEG and EMG daily. In 2011 we performed over 4400 EEG studies and almost 1400 EMG/NCS. We have 3 EEG Acquisition labs, 3 Portable EEG units and 3 EMG labs. The EMU, with 2 Acquisition beds, is shut down for 2 weeks every year but otherwise operates 50 weeks per year, 24/7. We also operate 2 Ambulatory monitors which collect files several days per week. All these 24 hour files must be reviewed by a Technologist. Telephone Transmissions are performed 2-3 days per week. We've recently had a number of WADA tests and IOM surgical cases.

We are very proud of our strong and dedicated Technologist team and the accomplishments of our highly successful training program. Historically Manitoba Technologists have won awards at our National Annual

General Meeting and Teaching Seminar and this year was no exception. Two of the three awards were presented to HSC Adult Technologists!

Sadly there are still no concrete job offers on the table at HSC. In fact our students have been told to seek employment at other centers. In the event that we lose even one of these future RET's, we will have to reduce services in our lab, as they have been sharing a generous portion of the lab's workload during their senior academic year.

Our lab has just 4 RET's who take call. Requests have dramatically increased over the past few years. Lately it's not uncommon to work a full weekday shift, work an hour or two for several evenings during the week, work a 10-12 hour weekend and then be back to a second full weekday shift before having a day off. We have also begun to feel the effects of the shortages at the SBGH lab; we are now being asked to do urgent patients for this hospital as well.

And to really top things off, our lab had to cope with a catastrophic system crash that happened in early August 2011. Instead of shutting the lab down, Technologists added "IT Specialist" to their list of credentials to keep the lab functional. For almost 6 months this meant another significant increase to our workload. To date a permanent solution is still 6-12 months away. In the meantime we continue to strain our already over utilized staff.

When it comes to convincing people to remain in Manitoba once Registered, well ... to say things are bleak would be an understatement. In Manitoba, our hourly wage is substantially lower than other provinces in the country and even amongst our peers in our own Union we sit near the bottom of the pay scale. And Canadian trained RET's are in high demand across the border. If we aren't competing on a National level, just Google "Neurodiagnostic Technologist" on an American head hunter's web site, and see how we fare on an International level! How long do you think it took for our 2 students to get job offers outside of Manitoba?

But here's hoping that by shedding some light on our skills and our situation, others will begin to understand the importance of maintaining a vibrant and viable Neurodiagnostic lab.

To read more about Neurodiagnostic Technologists, please visit the MAHCP website at [http://www.mahcp.ca/htmlfiles/NEWS/March\\_2012.asp](http://www.mahcp.ca/htmlfiles/NEWS/March_2012.asp)

***Read about HSC's Children's EEG Lab in the June 2012 issue of MAHCP News.***