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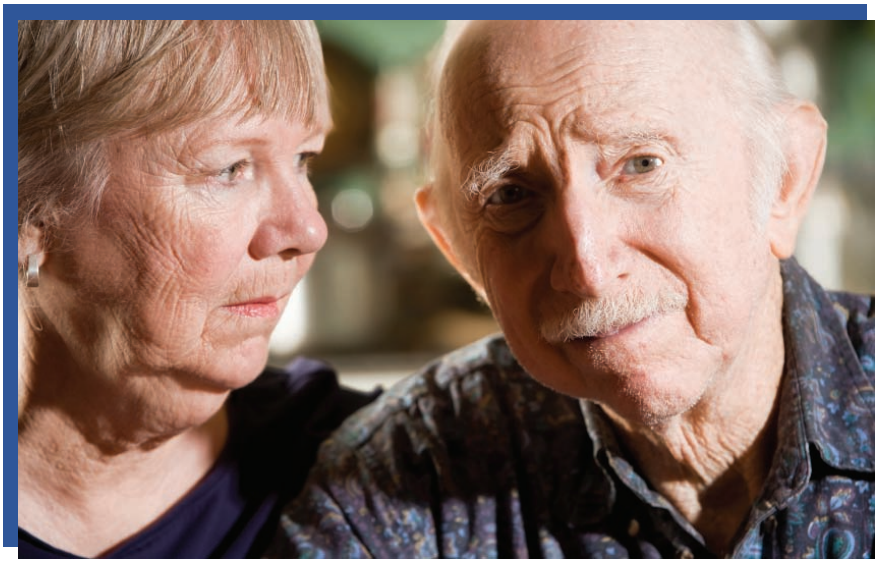
NeuroMatters

Connecting YOU to the Research

When Seniors Get Brain Injuries

IN THIS ISSUE

Ontario Neurotrauma Foundation
Fondation ontarienne de neurotraumatologie



Canadians are staying healthier and living longer than ever before. A century ago, one in 20 Canadians was a senior. Today, it's closer to one in seven with the number of seniors in the country set to double to ten million over the next 25 years.

Seniors today tend to be fit and active. It's not unusual to find people in their 70s or even their 80s playing tennis, riding a bicycle, or stretching in a fitness class at the local recreation centre.

The Ontario Neurotrauma Foundation (ONF) is continuing to investigate the impact of brain injury on seniors. In addition to a focus on prevention strategies aimed at reducing falls among seniors (please see page 2), ONF is interested in identifying research areas of particular relevance for people who sustain a brain injury late in life. To assess where ONF can have some impact, both a literature review and an analysis of Ontario hospital data and community services have been commissioned. Some initial areas of interest and information are highlighted in this article. The ONF-funded studies will help the Foundation pinpoint the research areas and approaches most likely to improve outcomes for people who sustain an acquired brain injury (ABI) late in life.

What sort of brain injuries are most prevalent among people over 65?

Both traumatic and non-traumatic brain injuries affect seniors. According to preliminary results of the Ontario ABI Dataset, younger seniors are five times more likely to be hospitalized for a non-traumatic brain injury than for a traumatic brain injury. Among older seniors age 85 and up, hospitalizations are more evenly distributed for traumatic and non-traumatic brain injuries. The Ontario ABI Dataset analysis is led by Angela Colantonio, Senior Research Scientist at Toronto Rehab and Professor at the Department of Occupational Science and Occupational Therapy at the University of Toronto.

In recent years, falls have overtaken motor vehicle collisions as the biggest cause of traumatic brain injury for the senior population. "With older seniors we see falls in the home and out in the community," said Shawn Marshall, Associate Professor in the Department of Medicine at the University of Ottawa and clinical investigator at the Ottawa Hospital Research Institute.

Marshall indicated that injury

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patterns might be poised to change because today's seniors are far more active than the previous generation was. The fact that today people 65 and older enjoy skiing or riding motorcycles might lead to an eventual increase in traumatic brain injury among younger seniors.

But at present, falls are the number one cause of traumatic brain injuries and it is the older senior who is most susceptible due to age-related issues like poor balance, side effects of medications, and weakening vision. A number of strategies exist to address the prevention of seniors' falls by minimizing risks. (Please see Prevention Strategies.)

The older brain is more vulnerable to disease and illness, and this means that non-traumatic brain injuries like brain tumours, vascular insults and other diseases of the brain account for a significant number of acquired brain injuries in older people. Colantonio's analysis of the Ontario ABI Dataset has shown that brain tumours are more of a concern in the younger elderly, while vascular insults tend to be more common among the older elderly.

Diagnosis

Both traumatic and non-traumatic ABI can be difficult to diagnose at any age. Assessments involving brain injuries can be even more complicated in the senior population. Cognitive problems in late onset brain injury can sometimes be confused with dementia or Alzheimer's disease when the patient is elderly. Even though the symptoms might be similar, it is crucial to get a diagnosis right because the treatments and expectations for recovery are very different.

In the case of a traumatic event, a brain injury can be overlooked when another more

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Seniors Prevention Strategies

In addition to its focus on the care and treatment of seniors once an acquired brain injury (ABI) has happened, the Ontario Neurotrauma Foundation (ONF) also has a strong interest in prevention. Since falls are the most common cause of traumatic brain injury in people over 75, ONF has focused on fall prevention strategies. In the past, ONF supported the "**Stay on Your Feet**" best practice intervention in three Ontario communities, and worked with other groups and regions in the province to learn from the successes of these communities.

More recently, ONF has become involved with two new initiatives.

Led by Ontario's Local Health Integration Networks (LHINs) in partnership with public health, and involving organizations such as ONF, the **Provincial Falls Prevention Project** was established last year as a priority project for LHINs. The goal of the project is to improve the quality of life and well-being of seniors through prevention of falls and fall-related injuries. An "**Ontario Falls Prevention Framework and Toolkit**" will be developed, along with a plan to support the LHINs and public health units in implementing the toolkit, monitoring implementation progress and evaluating prevention interventions.

ONF is also the sponsoring agency for the **Falls Prevention Community of Practice** under the Seniors Health Research Transfer Network funded by the Ministry of Health and Long Term Care. This Network links caregivers, researchers and policy-makers in an effort to improve the health and healthcare for Ontario seniors.

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obvious or pressing injury is present, especially when medical personnel are not familiar with an older patient's pre-injury level of competence.

ONF hopes to identify fertile areas of research in the area of diagnosis to help clinicians accurately identify ABI in seniors.

Dementia and TBI

The relationship between dementia and TBI is another area of interest for ONF. There is some indication that TBI can lead to dementia. Boxer's dementia, for example, is believed to be the result of repeated TBIs, however mild. But another view is that TBI does not cause dementia but rather speeds up the development of dementia by destroying neurons.

Pre-injury health profile

The health status of seniors before an injury has a direct bearing on their outcome. This factor is exaggerated in the case of a senior with an ABI because older people are more likely to have one or more age-related conditions at the time of ABI onset. The effect of these conditions and their treatment on outcomes is another topic that interests ONF.

Even when no other health conditions are present pre-injury, older bodies generally take longer to bounce back from an injury. "People who have a brain injury when they are older typically have a worse outcome than a younger person. A moderate injury can result in a severe outcome if you're over age 60," said Marshall.

Rehabilitation and seniors with late onset ABI

Indications are that changes are needed throughout the health care system to better accommodate seniors. Criteria for eligibility for rehabilitation may need to be revised in the face of increasing numbers of seniors with ABIs requiring care. Expectations about the length of rehabilitation and the definition of a successful outcome may also need adjusting.

"Rehabilitation is typically designed to get young people back to work. Many rehabilitation programs are not designed for older people," Marshall said. "We have to change our strategy with how to deal with seniors with brain injuries. We might need to decrease the intensity of a rehabilitation program and re-align the goals."

Marshall said that the benefits of rehabilitation depend upon the condition and fitness level a senior is in before the injury. A senior who is still driving and goes to the gym might be considered a better candidate for rehabilitation than a senior who was in a long-term care facility before sustaining the ABI. ONF considers this area one of particular importance given the predicted growth of the senior population.

Literature Review

The ONF-funded team working on the collection of evidence-based research in the rehabilitation field for people with ABI (ERABI) has been asked by ONF to provide a more in-depth review of the literature on late onset ABI.

Data Analysis

ONF has also commissioned a more in-depth analysis on ABI and seniors from the existing ABI Dataset project. "We aim to show the trajectory of older adults in the health care system from emergency room visits and hospitalization to post-acute care including inpatient rehabilitation and community services," Colantonio said.

Systems Issues

With the concerted focus of the health system on care and services for seniors, ONF anticipates the results of these two studies will help better identify what can be done within the health system to improve efficiencies and patient outcomes. ONF will be looking to partner with other stakeholders to see where it can have the best impact.

Functional Electrical Stimulation-Assisted Exercise:

Assessing the health benefits in individuals with a spinal cord injury

Functional Electrical Stimulation (FES) technology involves computer-generated patterns of small electrical pulses that stimulate paralysed muscles to produce movements. These movements may be limited to one limb, as in the muscles used for grasping, or they may involve whole body actions such as bicycling. Many studies have shown that FES-assisted activities may assist useful, intentional movements and others have shown that FES-assisted exercise, such as bicycling, may have some health benefits. Many of these studies, however, involved case reports or just a few study participants.

The Ontario Neurotrauma Foundation (ONF) recently funded a larger scale study into the effects of FES-assisted exercise on cardiovascular function and immune system properties. ONF wanted to discover whether this form of exercise might help limit secondary health complications in individuals with a spinal cord injury.

A team of researchers at the University of Western Ontario examined the effects of a 12 week program of FES-assisted bicycling in people with chronic (longer than 12 months) paraplegia or tetraplegia. Each participant was studied for 12 weeks when exercising, and for 12 weeks when not exercising but maintaining their regular forms of activity. In this way, each person served as his or her own "control" in the study.

The Study

The participants for the study were drawn from the outpatient population at Parkwood Hospital, part of the St. Joseph's Health Care Centre in London, Ontario. Potential participants between the ages of 18 and 65 were screened by their own physicians for inclusion in the study. Twenty-four individuals completed the program.

The FES-assisted bicycling training periods consisted of bicycling three times per week over a period of 12 weeks. Resistance was added once the participant was able to ride for 45 minutes straight on three consecutive days.

Results

Does FES-assisted exercise improve cardiovascular function and the body's immune system? The answer is a qualified "yes". Indicators of the status of these systems showed small but statistically significant improvements. Does it help individuals develop more stamina and perform the exercise better? Do participants enjoy this form of activity? These answers may be more compelling. Bicycling performance improved as the weeks went by, and the enthusiasm and feelings of well-being among participants were obvious. Many indicated that it was the psychological benefit that enhanced their quality of life. This is not surprising as other studies have shown that exercise itself is great for enhancing feelings of well-being.

"This ONF-funded study adds to a growing body of information about the benefits of FES-assisted activity. This study on its own may not be ground-breaking but in the context of the literature on FES-exercise, the study is making an important contribution to our existing knowledge." said Dr. Keith Hayes, Professor of Physical Medicine and Rehabilitation at the University of Western Ontario, who led the team of investigators.

The measurable results and the limited number of participants were insufficient to establish rigorous statistical conclusions. But self-reports of the incidence and severity of secondary complications indicate that FES-assisted exercise does benefit participants with respect to secondary conditions like pressure

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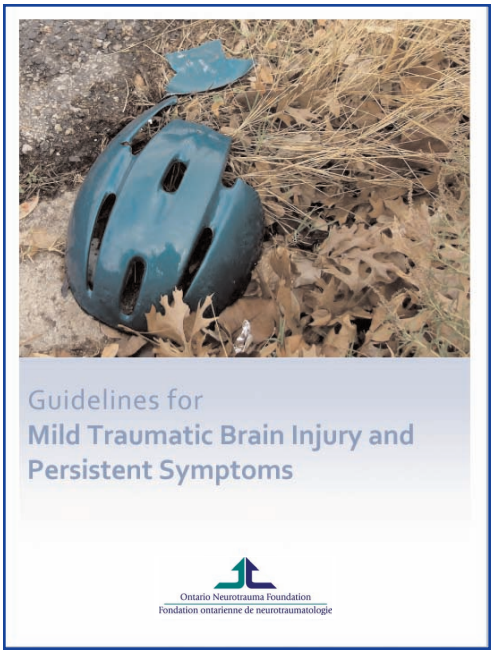
ulcers and infections. Ninety-six percent of the participants considered the exercise to have been good for their health, according to the survey results.

Knowledge Transfer and Implementation

As a result of the study, there was a groundswell of support to establish a clinical program of FES-assisted bicycling at the community-accessible Parkwood Hospital Fitness Centre in London. Trial participants and medical staff lobbied hospital therapists and the administration to establish the program with a "Try Before You Buy" approach. Individuals with SCI in the London area who are curious about whether FES-assisted cycling would be beneficial to them have the opportunity to try out the system in clinically supervised conditions.

"Participants felt a sense of reward. Because of this study, an FES-assisted bicycling program is now established at the hospital," Hayes said.

96% of the participants considered the exercise to have been good for their health



Guidelines for Mild Traumatic Brain Injury (mTBI) and Persistent Symptoms

In March of this year, the Ontario Neurotrauma Foundation released the *Guidelines for Mild Traumatic Brain Injury (mTBI) and Persistent Symptoms*.

The *Guidelines* have been developed to help healthcare professionals implement best practices in the care of adults who sustain an mTBI and experience persistent symptoms.

An adult who sustains an mTBI, also known as concussion, usually recovers within one week to three months. But 10 to 15% of individuals who sustain an mTBI will continue to experience significant symptoms beyond this anticipated recovery period. Persistent symptoms can include post-traumatic headache, sleep disturbance, problems with balance, cognitive impairments, fatigue, and changes in mood. Sometimes persistent symptoms interfere with an individual's daily-function, family relationships and ability to return to work and life roles.

Despite frequent mention in the popular press, mTBI (concussion) treatment remains an evolving area of enquiry. The *Guidelines* were drawn up with input from national and international experts on traumatic brain injury. Over a period of two years, experts used a consensus decision making process to devise the *Guidelines* drawing on existing evidence, clinical expertise and external reviews. The present *Guidelines* are a work in progress, and will likely be updated in a few years.

The *Guidelines* are available to view or download (7MB) on the ONF website. Go to www.onf.org and select "What's New" .

NOTE: *The Guidelines are designed to be used by health-care professionals only. If you are an adult who is experiencing persistent symptoms following an mTBI, please make your healthcare provider aware of these guidelines.*

Good Night ?

Characterizing sleep after a traumatic brain injury

Many people with a traumatic brain injury (TBI) have trouble sleeping at night. Some also report feeling tired during the day. For a person with TBI, poor sleep means more than just a long night. Disrupted sleep can slow down rehabilitation and affect outcomes.

Knowing how sleep changes after a brain injury could help medical professionals target strategies to improve sleep for people with TBI. The Ontario Neurotrauma Foundation (ONF) recently funded a studentship for a comprehensive investigation of sleep for individuals with traumatic brain injury. Catherine Milner, cognitive rehabilitation therapist and psychological counsellor, led the study as part of her doctoral research under the direction of Dr. Kimberly Cote of the Department of Psychology at Brock University.

Milner investigated and compared the sleep of individuals with a brain injury and those without.

Study participants were drawn from Brock University and the community of St. Catharines, Ontario. Forty people with an average age of just under 30 took part in the study. Half the participants had traumatic brain injuries ranging from mild to severe while the other half had no brain injuries.

Three quarters of the participants with TBI reported sleep problems. Some had trouble sleeping at night while others experienced daytime tiredness.

Everyone who took part in the study was observed sleeping in a sleep lab for three nights in a row. In the sleep lab, the brain waves of the participants were monitored while they slept. Electrodes, placed on the heads of participants before they went to sleep, sent signals to a computer, which recorded the brain wave activity.

The first two nights, the investigators observed and

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monitored participants as they slept to establish their typical sleep patterns. During the third night, various tests were conducted.

Sleep is divided into rapid-eye movement (REM) sleep and non-rapid eye movement sleep (NREM). NREM sleep has particular brain waves associated with its four stages. A person who sleeps seven to eight hours a night will typically spend most of the night in NREM sleep.

REM sleep, by contrast, produces brain waves that look very similar to those produced when a brain is awake. A person will typically have about ninety minutes of REM sleep each night.

In the sleep lab, participants with TBI generally took longer to get to sleep, displayed more movement when sleeping, and slept for shorter periods than the participants without brain injuries. These differences were reflected in the brain waves of both groups. The findings focus on differences in the NREM sleep.

The study participants with TBI showed fewer K-complex waves, which are a type of brain wave produced during the last three stages of NREM sleep. This finding was true of the participants with TBI regardless of the severity of the injury. "It is clear that sleep is disrupted after a TBI," Milner said.

Another finding was that the brains of participants with TBI were more alert while sleeping. "Our findings show that the brain with an injury is in overdrive," Milner said. "There is clear evidence that the brain in participants with TBI is more engaged during sleep when it should be resting."

My research is a first step in beginning to uncover the reasons for sleep complaints for people with TBI

The research also revealed differences between the two groups in terms of sleep patterns. Each of us has a unique sleep pattern. The sleep pattern of the individuals without brain injury showed greater consistency than the pattern of participants with TBI.

Milner has a number of ideas for future research programs on sleep and people with TBI. She would like to see a study focus on a single sleep complaint, i.e. either sleeplessness at night or daytime tiredness. She would also like to investigate how medication and pain affect sleep for people with TBI. She thinks that a study focusing on treatments for sleep problems would also be beneficial. "My research is a first step in beginning to uncover the reasons for sleep complaints for people with TBI," Milner said. "A study that involves a treatment component to target improvement of sleep prior to rehabilitation would prove useful."

HOLD THE DATE

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Neuropathic Pain

May 27th @ 11:30 am

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Contact CPA Ontario for more information
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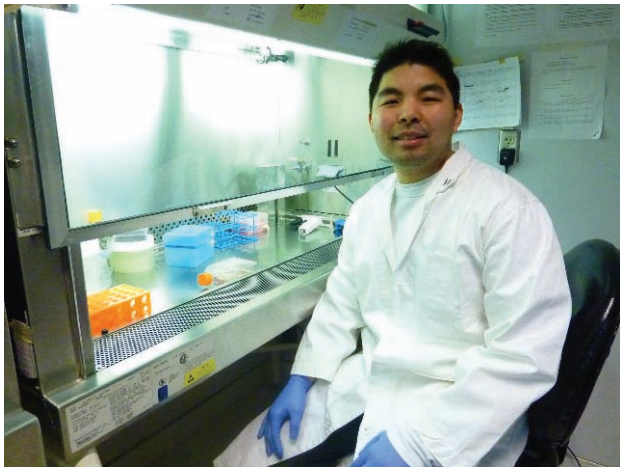
What if...

a spinal cord could repair itself?



Stem cell research is new and promising. It offers the possibility of reversing nervous system damage previously assumed to be permanent. Scientists are experimenting with how to apply stem cell technology successfully to remedy conditions like multiple sclerosis, Parkinson's disease, Lou Gehrig's Disease and spinal cord injury, among many others.

The Ontario Neurotrauma Foundation (ONF) is cautiously optimistic about the potential of stem cell research. Recently, ONF awarded a studentship grant to Howard Kim, a promising young scientist at the University of Toronto's Institute of Medical Science. Kim is working under the direction of neurosurgeon Professor Charles Tator and biomedical engineer Professor Molly Shoichet.

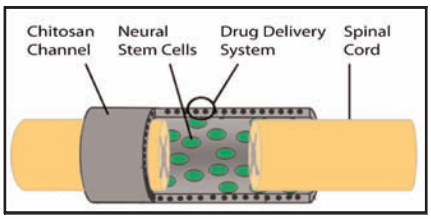
Kim's ONF-funded research focuses on the application of adult neural stem cells on spinal cord injuries. He conducted his experiments on rats whose spinal cords were completely severed. In these rats, there was a total loss of motor function and sensation below the level of injury.

Typically, when neural stem cells are transplanted into a spinal cord, many of them die. So, one of Kim's objectives was to figure out a way to keep the stem cells alive after transplantation.

Neural stem cells have the ability to turn into neurons (the main signalling cell type of the nervous system) or a cell that supports neurons. Typically, the majority of stem cells turn into support-type cells after transplantation. Nobody knows yet what the optimum combination of neurons and support cells is, but scientists agree that that they want to be able to exercise greater control over what sort of cell a transplanted stem cell becomes. "We wanted more control but we're not sure what the ideal formula is yet," Kim said.

In order to improve both the survival rate and the ability to select the cell type, Kim tried transplanting the stem cells using a combination of drugs and the insertion of a simple device.

The device is a tube made from chitosan (pronounced ky-tow-san), a substance derived and purified from crustaceans like shrimps. In his experiments, Kim placed the two ends of the severed spinal cord in either end of the tube or channel. The channel contained neural stem cells that had been treated



with drugs. Kim was hoping that the drugs together with the chitosan tubes would improve the success of the stem cell transplantations. He explained, "Stem cells survive better if they have something to attach to".

And it turns out, at least from his initial experiments, that Kim has hit upon a winning combination of drugs and biomaterials. In his experiments, both the survival rate of the stem cells and the ability to control their transformation were better than in the control groups.

As a second part of his research, Kim also investigated the toxicity and durability of the biomaterial chitosan in SCI applications. He compared chitosan with two other biomaterials commonly used in medical procedures and concluded that chitosan proved to be both non-toxic as well as optimally durable for the purposes of spinal cord injury repairs.

Kim is submitting his research to academic journals for publication and has given presentations of his preliminary findings at international conferences including the Society for Neuroscience conference in Chicago. "I think stem cell therapy is very promising," Kim said, "but I would caution against being overly optimistic about the current state of the technology. There's still a lot we need to learn about how to harness the full potential of stem cells before they can be truly effective as part of a cure for SCI."

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