

NeuroMatters

Connecting YOU to the Research

Preventing Heart Attacks Before They Happen

How to identify a silent killer

Imagine, finding out you've had a heart attack when you didn't even know you were at risk. You didn't even have high blood pressure, a weight problem or family history.

Unfortunately, this happens far too often for individuals with spinal cord injury (SCI). One day, those without any symptoms find out they have coronary arterial disease, a condition that eventually leads to heart disease or stroke. Until something happens, they were unaware there was anything wrong.



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This scenario was put to the test in a research study funded by Ontario Neurotrauma Foundation (ONF) and carried out with 47 participants with SCI. The group was selected specifically because they all believed they had "healthy hearts." They were "without symptoms" (that is, asymptomatic). None were smokers or carried any of the high-risk metabolic risk factors associated with poor cardiovascular health such as high blood sugar, obesity or family history.

"Our participants all felt fine," explains Dr. Masae Miyatani, principal investigator for the study. "However, what we found during our research told another story about their health.

"The individuals had damage to their arteries that they didn't even know was there."

Almost one third was identified as having asymptomatic vascular end-organ damage (atherosclerosis). This was indicated by the "stiffness of their arteries" caused

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by the building up of plaque and reduced elasticity in the blood vessels that supply blood to the heart. Stiffening of the arteries, measured using Aortic Pulse Wave Velocity, limits the blood flow to the heart's muscle. Coronary artery disease (CAD) is a precursor to heart disease, resulting in heart attacks or strokes.

Arterial damage and risk

Asymptomatic CAD is a particularly dangerous condition because, as the name suggests, there are no obvious symptoms that warn the individual that something is wrong.

Persons with SCI share the risks of CAD with the general population, but also risks specific to their level of injury, duration of injury and severity of injury, etc. This makes asymptomatic CAD a growing concern for those with SCI.

- CAD is the leading cause of death among persons with SCI.
- Individuals with chronic SCI have higher cardiovascular mortality rates and die at younger ages compared to those without injuries.
- Within thirty years post injury, 46% of deaths are due to CAD.

A Simple, Non-Invasive Test

Aorta Pulse Wave Velocity (aPWV) tracks the speed of blood flow in metres per second in the aorta, the body's largest blood vessel. The calculation is the current gold standard measure of aortic stiffness and elasticity – the slower the aPWV the better.

Currently, aPWV is only being used for research purposes but it is hoped that eventually it will become a standard test for individuals with SCI.

Keeping fit, with exercises appropriate for you, certainly may be one way to limit the damage on one's arteries. Even if you don't have symptoms, you need to exercise to get healthy arteries – and minimize your risk of a heart attack.

New ways to assess arterial health

Dr. Miyatani's research study, carried out through Toronto Rehab, looked at new ways to assess damage to arteries. The results shed some positive light on how to better predict risk in the future and what can be done to turn around such statistics.

Up until this study, there were no published guidelines for detecting asymptomatic CAD among people with SCI and standard pulse wave technology had not been used before outside the general population for its early detection.

By using aorta pulse wave velocity as a "predictor of the future", this study paved the way not only for measuring and assessing arterial damage, but also for providing a clearer understanding of what an individual with SCI can do to prevent damage.

The difference maker – physical activity

The results of the study are a wake-up call for individuals with SCI who may not be participating in enough physical activity to keep their arteries healthy and their blood flowing by improving cardiorespiratory fitness.

"Keeping fit, with exercises appropriate for you, certainly may be one way to limit the damage to one's arteries," says Dr. Miyatani. "Even if you don't have symptoms, you need to exercise to get healthy arteries – and minimize

Heart Disease

Traditional risk factors:

- Diabetes or glucose intolerance
- Hypertension
- Obesity
- Low cardio-pulmonary fitness
- High Cholesterol
- Smoking
- Family history
- Aging

SCI specific risk factors

- Neurologic Level of Injury: an injury above T6 spinal cord results in damage to the autonomic nerves, which control the cardiovascular system. In addition, those with an injury above T6 are not able to detect the pain of even a mild heart attack
- Duration of injury (the older you are when you sustain your injury, the greater the risk)
- American Spinal Injury Association (ASIA) impairment scale; people with complete SCI are more likely to have CAD risk than people with incomplete SCI

your risk of a heart attack.

"So we recommend that persons with SCI engage in physical activity, such as following the new Physical Activity Guidelines now available on ONF's website <http://www.onf.org>. You need to do this even though you don't smoke or have a metabolic issue."

The above research, Defining the Associations between Arterial Stiffness, and Coronary Artery Disease Risk Factors was supported by ONF.

Fitness and Heart Health

It matters to keep moving and stay active

A research study at McMaster University in Hamilton, **Cardiovascular Health in Individuals with Chronic Spinal Cord Injury**, assessed baseline traditional and novel cardiovascular risk factors among adults with chronic SCI. They are currently assessing the role of physical exercise in preventing or improving cardiovascular disease (CVD) risk. The study was funded by the Ontario Neurotrauma Foundation.

How it was done

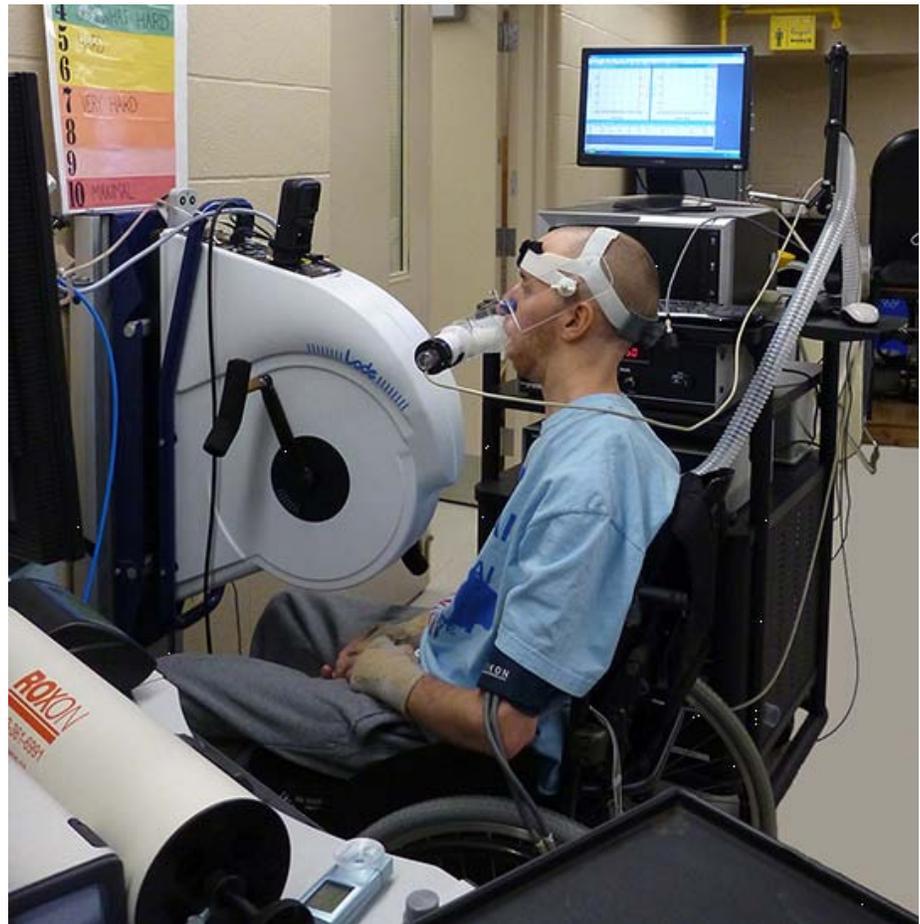
There were 30 participants with SCI in the initial baseline study, which measured body composition, aerobic fitness and arterial health (artery structure and function, and assessment of blood flow patterns through the arteries). The average age was 42 years, 9-13 years post-injury, and different injury levels and completeness.

What happens post injury?

Changes in body composition

Apart from traditional CVD risk factors such as increased waist circumference, high blood pressure or poor diet, there are obvious reasons for declined cardiovascular health in the months and years following an SCI as the body adapts to its new condition.

Post-injury an individual is not able to participate in many common aerobic exercises; this physical inactivity leads to a decrease in both the quantity and quality of muscle mass, bone density and fat mass gain. These changes contribute to many metabolic abnormalities and chronic diseases such as insulin resistance, diabetes, CVD, etc.



Peak oxygen uptake test

The result is exposure to risk factors associated with obesity without any significant weight gain.

How the data was gathered

Various methods were used in order to create a comprehensive risk factor profile of the study participants for their overall cardiovascular health.

Body composition was assessed in various ways:

- Measurement of body mass index using a floor scale, and waist circumference, using a Gulick Tape Measure with a tensioning device for accuracy
- DXA (or DEXA, Dual Energy X-ray Absorptiometry) to measure percent of body fat: fat mass, bone mass, and lean mass.
- Blood biomarkers

Aerobic fitness was measured through the peak oxygen uptake test (VO₂peak) where participants performed a symptom-limited graded arm cycle ergometer test. A questionnaire was also used to gather information on activities of daily living and leisure time physical activity.

In order to look at artery structure and function, researchers used ultrasound and pulsed wave Doppler to track artery size as well as quantity, speed, and direction of blood flow. Results showed that an SCI injury does lead to changes in structure and function of arteries (arteries became smaller in diameter and stiffer). This can result in altered flow patterns and

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arteries may lose their ability to dilate or constrict.

Exercise does matter

According to the literature, exercise definitely has a positive effect on aerobic health and body composition in able-bodied individuals. There is also no doubt that exercise keeps the blood flowing, which keeps arteries healthy. Although the results from this final exercise phase aren't in, it is believed that the increased blood flow and systemic effects of getting the heart pumping through exercise can be a potent stimulator for improved artery structure and function.

"Individuals with an SCI are at high risk of the negative effects of physical inactivity on their cardiovascular health," says Julia Totosy de Zepetnek, lead investigator for the study.

"But exercise can make a big difference. Increasing physical activity to improve aerobic fitness, whatever you can do: standing, walking, arm exercise, functional electrical stimulation, body weight supported treadmill training – these can all make a difference."

"Anyone with a SCI needs to understand that the structure and function of the arteries as well as other metabolic alterations are

being affected by the injury" concludes Totosy de Zepetnek, "you cannot reverse your injury, but there are positive things you can do; i.e. increase your physical activity."

For more information on this study please contact Julia at totosyj@mcmaster.ca

Next Steps

In the second phase of the study, researchers at McMaster University are assessing the effects of four months of following the Physical Activity Guidelines on cardiovascular health and fitness in people with SCI.

The importance of Exercise

The leading causes of death among people with SCI are chronic conditions often related to physical inactivity, such as heart disease. According to the recently released Physical Activity Guidelines specifically for individuals with SCI, healthy adults with SCI are advised to participate in at least 20 minutes of moderate to rigorous aerobic activity two times per week, as well as strength training exercises for every major functioning muscle group two times per week.

The Guidelines can be found at www.onf.org



Working out at the McWheelers program in Hamilton



Finally Home with an Acquired Brain Injury

Coping During Those First Six Months

It's difficult to prepare anyone for the physical, cognitive, emotional and social changes that occur following a moderate to severe acquired brain injury (ABI). There are physical changes such as fatigue, sleep disturbances, difficulty with balance and headaches. The individual may have emotional and psychological impairments like mood swings, depression, difficulty coping with crowds, and sensitivity to noise and light. There may be personality changes, becoming seemingly a different person to family and friends.

Yet, the majority of individuals are discharged from a hospital or rehabilitation centre with little or no appropriate preparation or resources to help their family caregivers cope in the days and months ahead. An impromptu visit to a shopping mall or a simple task at home suddenly can become a challenging situation.

Two years ago, a team of researchers and clinical experts in Toronto set out to learn more about this transition.

"No one had ever mapped out those first six months," explains Sonya Canzian, a nurse and Program Director, Trauma, Neurosurgery at St. Michael's Hospital and the project's principal investigator. "We were able to explore the process of adaptation for the individual and the family caregiver, and see what really happens once they are back in the home and community."

Collecting the data

The team was successful in capturing valuable information about the pattern of transition, overwhelming personal life changes and significant stressors experienced by the individual with ABI and their family caregivers. Data was collected through telephone calls (recorded with consent), placed weekly to the homes of selected families for the first 6 weeks following discharge. These were reduced to biweekly for the following six weeks, and then monthly for the last three months. Individuals with ABI and a family member were asked about the challenges they were facing, and specifically, supports they needed.

Stages of coping

A major insight from the study was learning the distinct stages experienced by each family. For example, when someone first returns home, there is a focus on recovery and a sense of hope that, now, "everything will be better". This stage usually ends with an event that makes it clear that a change has happened and things are different now. There follows a stage of exhaustion, and then a time of adjustment as everyone tries to cope day by day. Eventually there is some level of understanding and acceptance of the loss.

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The complex issues of transition

In almost all instances, once an individual with an ABI returns home, the primary caregiver is a family member. The study confirmed that post-discharge, there is a tremendous period of adjustment.

"We're sending people home unprepared to manage the complexities of ABI such as episodic anger, mood swings, and depression," concludes Canzian, "It's like they leave with hidden diseases, return to their homes and their communities and just cope. We really need to do a better job of preparing caregivers."

Because of sample size, the study was not able to discern a difference in regards to coping and adjustment between those being discharged home directly from acute care versus those who attended a rehabilitation facility. In-patient rehabilitation may provide some opportunity for adjustment and education; those going home directly from a hospital may be more likely to be overwhelmed and unprepared.

Managing and understanding change

Despite discharge planning and preparation, much of the burden felt by family caregivers was attributed to the limited knowledge about how to care for loved ones, and confronting the reality of the changes in their lives. The study gives new insight for understanding the complex issues of this important initial transition and identifies the need for pre-discharge education for caregivers.

By understanding the stages better, caregivers can be better prepared for the challenges they may face and then, given strategies to use. Analysis from the study, for example, demonstrates the value of psychological assistance.

Additional supports could include the use of a case manager and other community, medical and clinical supports for at least the initial six months.

In support of these findings, the research team found that although the phone calls were intended for data gathering, individuals continued to express gratitude for being able to talk with someone about their experience.

Next Steps

The next step is to discuss the results with rehabilitation providers, identify recommendations and see how best to introduce assistance before individuals are discharged. Ideally, this would result in a Canadian based program to assist in the transition home for those with ABI. Such programs do exist but are not always readily available to individuals and families. ONF suggests that this presents an important opportunity for brain injury associations to play a lead role.



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"They are absent from school for weeks or longer, which may jeopardize moving to the next grade, memory loss can affect their grades, and they are unable to participate in sports and extra curricular activities."

Not your adult concussion

Children and youth with concussions present a unique diagnostic challenge. Their brains are still developing, and their physiology and ways of communicating are different from adults. The management of concussions is also different because children and youth are involved in sports and school. Even the drugs prescribed for adults usually aren't approved for a younger population.

Concussions also affect children differently. More than any other age group, children experience post concussive syndrome (PCS): nausea, headaches, thinking problems, difficulty processing and remembering, and depression. PCS disrupts daily living routines and decreases participation in school and activities. There's also a psychological impact on kids separated from their peer groups. This impacts their sense of confidence and belonging, and can lead to depression, further absenteeism and lower quality of life.

Engaging the world's experts

There has been tremendous progress in recent years in developing concussion guidelines to assist health practitioners who treat adults. For example, in 2008, ONF sponsored the development of the now internationally-known, **Guidelines for mTBI and Persistent Symptom for Adults**. The Guidelines are available on the ONF website www.onf.org. With more research available on brain injury in children, it's time to gather that evidence and develop similar

Census data across eight paediatric emergency departments across Canada show 1 in 70 paediatric emergency department visits is for concussion.

guidelines for our young population.

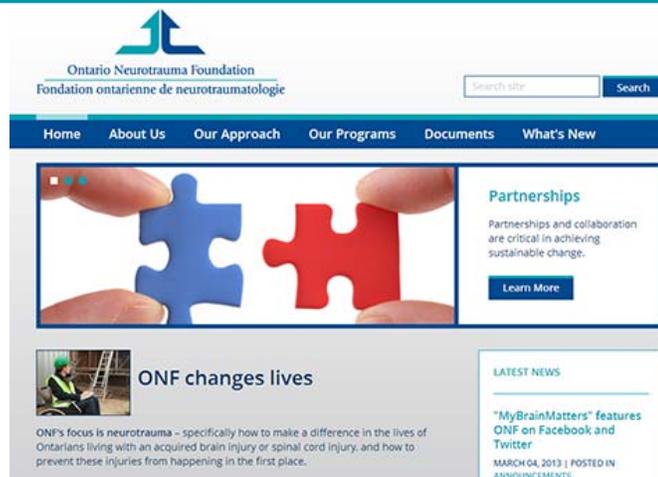
The core team has engaged over 30 experts to form a Consensus Panel, representing

international experts across the full spectrum of paediatric health and sports concussion. The team will look at the comprehensive management of concussion from a medical, psychological, cognitive and social perspective. The first draft is being developed at a consensus conference in late 2013, and then there will be a final review before the release date in March 2014.

Research to results

A key part of the project is making sure that the guidelines are clear and get used. Through support from ONF, the team is building commitments with school boards, hockey associations, paediatricians, etc. to ensure the broadest sharing of knowledge, acceptance and uptake.

"The best way to lead change is to get results from research and put them in the hands of those who can make them most effective", concludes Zemek.



The Ontario Neurotrauma Foundation is pleased to announce the launch of our new website.

Check it out at www.onf.org

The new website features information about:

- Our three programs – Acquired Brain Injury, Spinal Cord Injury and Injury Prevention
- Our approach to research and implementation and the projects that we fund
- Important relationships we have with our partners
- NeuroMatters, our quarterly newsletter, as well as other helpful documents and guidelines published by ONF

A Clear and Urgent Need



“Finally,
it is
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nothing mild
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about
mTBI/concussions.”

Developing Concussion Guidelines for Children and Youth

The need is clear and urgent. When compared to adults, concussion is the most common injury in children and young adults under 21. The persistent symptoms of concussion, most common in children, can have a devastating effect on the quality of life of young people and their families.

Up until now, there have been no specific guidelines for the diagnosis and management of paediatric concussion. This is about to change. This past February, a core team of experts began the process of developing guidelines for diagnosing and treating paediatric concussion. The guidelines will address the full spectrum of issues

faced by healthcare professionals and family caregivers: diagnosis, early management, persistent symptom management, as well as returning to learn and play recommendations.

Once in place, it is hoped that more young people will avoid a potentially more serious, second concussion, and the frequency

and severity of persistent symptoms will be reduced.

“We see it as extremely important to come up with ways to reduce, to prevent and find better solutions to manage concussions in children and youth,” says Dr. Roger Zemek, Emergency Physician at the Children’s Hospital of Eastern Ontario (Ottawa) and primary investigator for the project.

“Finally, it is recognized that there’s nothing mild at all about mTBI/concussions.”

Looking to the future

Zemek has been particularly influenced by the specific way in which concussions can affect not just a child or youth’s current return to school, but also the way in which persistent symptoms after the injury can affect school and social life.

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