



Concussion in Women and Girls

Saturday September 23, 2017 | BMO Education & Conference Centre, Toronto

Presented by:



Women and girls are a population that is underrepresented in research and programming to address concussion in sport and elsewhere, including domestic violence and the performing arts. This fall, The Canadian Concussion Centre at the Toronto Western Hospital was proud to present its inaugural symposium focusing on this topic, titled Concussion in Women and Girls 2017. We were joined by an international lineup of distinguished and emerging researchers who shared their insights on prevention, diagnosis, management, and policy on concussion in women and girls. The symposium included interactive knowledge translation opportunities, as well as remarks from symposium patron Cassie Campbell-Pascall, captain of 2 Canadian gold medal Olympic hockey teams. The event concluded with current Ontario Minister of Tourism, Culture, and Sport, The Honourable Eleanor McMahon, sharing her vision for Ontario in addressing concussion in women and girls for the future.

Co-Chairs:

Carmela Tartaglia, M.D., FRCPC, Marion and Gerald Soloway Chair in Brain Injury and Concussion Research
Associate Professor, Tanz Centre for Research in Neurodegenerative Diseases, University of Toronto

Swapna Mylabathula, MD/PhD Candidate, University of Toronto

Charles Tator, OC, MD, PhD, FRCSC FACS, Professor of Neurosurgery, University of Toronto; Division of Neurosurgery, Toronto Western Hospital; Senior Scientist – Krembil Research Institute; Director, Canadian Concussion Centre ; Board Member, Parachute Canada

Program Committee:

Shannon Bauman, MD, CCFP (SEM), Dip. Sport Med (CASEM) Primary Care Sports Medicine Physician, Medical Director of Concussion North Royal Victoria Regional Health Care Centre

Angela Colantonio, Director of the University of Toronto's Rehabilitation Sciences Institute, Professor of Occupational Science and Occupational Therapy

Pamela Fuselli, MSc, VP, Knowledge Transfer & Stakeholder Relations, Parachute Canada

Robin Green, PhD, CPsych, Canada Research Chair (II), Senior Scientist, Toronto Rehab, Associate Professor, Department of Psychiatry, Neurosciences, University of Toronto

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Taryn Taylor, BKin, MSc, MD, CCFP(SEM), Dip Sport Med, Team Physician Ottawa 67s & Ottawa Fury & Ottawa RedBlacks, Primary Care Coordinator PGY3 Sport Med Fellowship, Carleton Sport Medicine Clinic

Mike Ellis, MD, FRCS, Medical Director, Pan Am Concussion Program Co-Director, Canada North Concussion Network

Jamie Kissick, MD, CCFP (SEM), Dip Sport & Exercise Medicine

Summary of Presentations

1. Treatment of Postconcussion Syndrome in Women and Girls

Charles Tator, OC, MD, PhD, FRCS FACS, Professor of Neurosurgery, Toronto, ON, Canada **Ann Mansur**, Medical School, University of Toronto; **Tyler Hauer**, Medical School, University of Toronto;

Photophobia and computer screen intolerance are common symptoms in patients suffering from postconcussion syndrome (PCS). When severe and prolonged, these symptoms can prevent return to school in children and adolescents and return to work in a variety of occupations requiring regular computer use. Photophobia and computer screen intolerance can be very disabling and may be due to the recently discovered direct axonal projections from photosensitive retinal ganglion cells to the thalamic pain appreciation centres.

Many strategies have been tried including over the screen tints of various shades, sunglasses and regulation of screen brightness. Even with these manipulations, most patients with these symptoms remain significantly disabled. In the present study, we investigated the use of a non-LCD screen overlay on a computer. This screen overlay refreshes only when the viewed image is changed, and at a very low rate in contrast to the regular LCD screen which refreshes constantly at 60 hz. The non-LCD screen was provided by Iris Technologies, Toronto.

We assessed 29 PCS patients suffering from photosensitivity and computer screen intolerance, and found that the non-LCD computer screen had several advantages. In both sexes, there were fewer symptoms elicited and the symptoms were of lower severity with the non-LCD screen. As well, we found that female PCS sufferers had significantly worse symptoms than males with the LCD screen.

This is a promising strategy for treatment of PCS patients who have photophobia and computer screen intolerance. Further studies of this technology are being planned.

2. The Silent Epidemic: Concussions in Women Experiencing Intimate-Partner Violence

Eve M. Valera, Ph.D, Assistant Professor, Harvard Medical School, Research Scientist, Massachusetts General Hospital, Boston, US

This presentation provided an overview of the prevalence and sequelae of concussions in women experiencing intimate-partner violence (IPV). Results from two samples of women who had experienced

IPV showed that 75-100% of the women sustained at least one IPV-related concussion, and 50-75% sustained repetitive IPV-related concussions. Additionally, having a higher number of and more recent partner-related concussions was associated with: poorer learning, memory, and cognitive flexibility; greater rates of depression, anxiety, and PTSD symptomatology; evidence of a reduced capacity to engage in cross-neural network interactions necessary for efficient cognitive performance; and lower diffusion in select white matter fiber tracts. Victims rarely sought medical attention and most of these concussions went completely unacknowledged and untreated. It is hypothesized that the post-concussive difficulties reported by many women experiencing IPV may hinder a woman's ability to escape her dangerous and abusive situation. These results call for awareness-raising of this "silent epidemic" and more research aimed at understanding the sequelae of IPV-related concussions.

3. Rehabilitation issues in women who have suffered a Concussion

Donna Ouchterlony, MD,CCFP, LM, Director of Special Projects St. Michael's Head Injury and Concussion Clinic, Assistant Professor University of Toronto, Toronto, ON, Canada

Women are physiologically different. Studies have shown that head and neck mass in women is 43 to 30 % less girth and mass than in men. There is a difference in dynamic stabilization during head acceleration and there is significantly greater head neck peak angular acceleration and displacement than in males. Tierney et al, Medicine and Science in Sports and Exercise 2005.

There is a higher incidence of concussions and a longer recovery period in females. Female athletes have a higher incidence of reported concussion in sports. There is also greater time lost from sport in women than in men. Journal of athletic training, 2016; 51(3):189-194

Women's sex differences in cognition correspond to patterns of ability rather than overall intelligence. Females excel on tests that measure recollection, advantage on processing speed involving letters, digits and rapid naming tasks, are better at object location memory and verbal memory and verbal learning.

Women suffer more stress than men and their coping style is more emotion-focused than that of men. Elsevier 2004

Women are 1.4x more likely to suffer from stress, anxiety and depression. 8/10 Married women do more household chores than their husbands, 50% do 13 hours or more. British Institute for Public Policy Research published in The Guardian 2012

Women carry more multiple roles. The more children in the family the greater the stress. The more other family members the greater the stress. Fulfilling both professional and household work duties can be a source of stress.

Rehabilitation implications and strategies. Good history is critical including family and work history, number of children and any issues with children, extra people receiving care and support in the community. It is necessary to provide extra resources, activate psychosocial interventions and to expect and plan for longer recovery.

Household help is essential which can sometimes be obtained through Insurance, CCAC, and finally Support networks.

4. Long-Term Cognitive and Psycho-Affective Outcomes in Women and Men Collegiate Athletes Following Sport-Related Concussion

Dave Ellemberg, Professor, Director, Laboratory of Neuropsychology of Sport and Development, Department of kinesiology, University of Montréal; **William Sauvé**, Department of kinesiology, University of Montréal; **Veronik Sicard**, Department of kinesiology, University of Montréal, Montreal, Québec, Canada

Accumulating data suggest that women are more susceptible to incur a sport concussion. Despite concussion being a serious public health concern and the increasing participation of women in sport, long-term outcomes in women athletes are poorly understood, potentially limiting the clinical management of this injury. In a series of studies, we examined whether sex influences the long-term cognitive outcomes in athletes with a history of concussion (HOC; 6+ months from injury). Accordingly, we tested 196 asymptomatic student-athletes (98 with a HOC; 98 matched controls). The sample included both women (n=98) and men athletes (n=98). Participants completed the Cogstate brief battery, to which we added a 2-Back condition to increase cognitive load. The results revealed that irrespective of sex, athletes with a HOC were slower and less accurate relative to controls on the N-back Tasks ($p = 0.01$). Moreover, women athletes having a HOC responded significantly more slowly than men on the 2-Back condition ($p = 0.02$), a measure of executive functions. These results cannot be explained by psycho-affective factors, as one month after injury both women and men athletes do not present any evidence of depression or mood disturbances. The current results reaffirm the presence of subtle, yet long-term alterations in aspects of executive functions following a sport-related concussion. More importantly, our results highlight that women athletes exhibit alterations of greater magnitude than men. Therefore, the sex difference previously observed in the days and weeks following a concussion may persist well into the chronic phase of injury.

5. A Comparison of US High School and Collegiate Sports-Related Concussion Rates and Characteristics by Sex

Christy Collins, PhD, President, Datalys Center for Sports Injury Research and Prevention, Indianapolis, IN, US

A Comparison of United States (US) High School and Collegiate Sports-Related Concussion Rates and Characteristics by Sex, Datalys Center for Sports Injury Research and Prevention in Indianapolis, Indiana. The purpose of this presentation was to describe ongoing injury surveillance studies among high school and college athletes in the US and to compare sports-related concussion rates and characteristics by sex. Collegiate women had a significantly higher rate of concussion in soccer, basketball, baseball/softball, and lacrosse compared to collegiate men, and high school girls had a significantly higher rate of concussion in soccer, basketball, baseball/softball, and indoor track and field than high school boys. There was no difference in the average number of concussion systems by sex at the collegiate or high school level. Females had a longer symptom resolution time and time until return to play than males, but this was only statistically significant at the high school level. More research is needed to further examine reasons for concussion-related disparities in males and females. Injury surveillance is a vital tool for developing evidence-based intervention and policies. When interpreting results of injury

surveillance studies, it is important to keep in mind who collected the data, what sports were included, how exposure and injury were defined, generalizability of results, and comparability across surveillance systems.

6. Review real case examples in female hockey that could be attributed to lack of understanding/acceptance by key stakeholders that could change proper diagnosis and positive treatment into putting an athlete at risk

Fran Rider, C.M., Ont, President, Ontario Women's Hockey Association, Mississauga, ON, Canada

The OWHA and Hockey Canada are committed to maintaining the health, well-being and safety of its participants through the engagement of all stakeholders including players, parents, teammates, team staff, officials, administrators and others. The primary objective is to provide a positive environment focusing on respect and fair play resulting in prevention of concussions with a game related focus on reduction of violence including contact to the head and hits from behind.

Concussion education is delivered through mandatory certification programs as well as through seminars, meetings, web sites, social media, media and word of mouth. Challenges occur when one or more stakeholders doesn't know, understand or accept responsibility for a variety of reasons such as the importance of a game, the fact that scouts will be in attendance, the player is a top player and the player really wants to play.

Four actual cases were presented that demonstrated the importance of education, a buy-in from all stakeholders and a positive relationship between sport and medical experts in our collective goal to support participation in sport and the safety of participants.

The OWHA will continue to work with Hockey Canada and all stakeholders in the best interests of the physical and mental health of participants. We sincerely thank Dr. Charles Tator and the incredible network of professionals who work every day for the health and well-being of people.

7. Concussion Hits Home: An Awareness Campaign on Domestic Violence

Ruth Wilcock, Registered Psychotherapist (Qualifying), Executive Director, Ontario Brain Injury Association, Toronto, ON, Canada

Summarized by the CCC

Concussion has become a widely discussed topic in scientific and lay circles, but there are still some aspects that are yet to emerge at the forefront of public awareness and attention. It is often seen described in sport, but concussion in women is also a significant topic relating to domestic violence. Various statistics emphasize the importance of awareness, and of the prevalence of head injury in domestic violence – the Sojourner Centre reports, for example, that 92% of reported incidences of domestic violence involved hitting a partner in the head multiple times. Many survivors do not receive appropriate medical care and most do not know that they have sustained a concussion. There is clearly much scope for increasing education and awareness to address concussions in women in the context of

domestic violence, with the aim of improving the lives of survivors and preventing further injury. The Ontario Brain Injury Association aims to increase awareness and education for survivors to enable them to access the treatment and support that they need.

8. Sugar and Spice May not Be so Nice: Concussions in Girls

Laura Purcell, MSc, MD, FRCPC, Dip Sport Med. Associate Clinical Professor, Department of Pediatrics
McMaster University , Hamilton, ON, Canada

The majority of concussions, particularly sport-related concussions, occur in people under 20 years of age. Within the pediatric age group, 2/3 of concussions occur in adolescents aged 13-17 years of age and 1/3 occur in children aged 5-12 years of age. Although the evidence in the literature is mixed, it tends to indicate that girls are different when it comes to concussion in a number of areas, including:

1. Preinjury Differences: Participation rates in sports differs between boys and girls (2-3:1 males:females); males tend to play more contact sports; females tend to report more baseline symptoms; and are more likely to report concussion injuries than males.
2. Incidence/Sport Differences: Males tend to play more contact sports than females and sustain more concussions than females in general (about 75% of concussions occur in males). However, females sustain more concussions in the same sport. Girls soccer has the highest rate of concussions (34.5% of all soccer injuries in girls in one study). The reasons for this are not clear but hypotheses include decreased neck strength, larger ball-to-head size ratio, and reporting bias.
3. Presentation Differences: Girls tend to report more symptoms and more severe symptoms post-concussion than boys.
4. Recovery Differences: Adolescent females tend to take longer to recover and require more interventions for symptom resolution post-concussion.

There is an urgent need for research in younger age groups and the effect of gender in concussion risk, presentation and management to help guide development of concussion protocols.

9. Concussion Policy and KT: Considerations for Women and Girls

Swapna Mylabathula, MD/PhD Candidate, University of Toronto & **Sandhya Mylabathula**, MSc/PhD Candidate, University of Toronto, Toronto, ON, Canada

While there has been an increase in concussion policy in various jurisdictions in the past few years, there is still very little to be found focusing on concussion in women and girls, both in public and organizational policy. Because policy is a vehicle for change at a population level, it can be a useful tool in translating the findings from current research to practical application in the hallways of schools, sporting arenas and fields, and on our shared roadways – but it is important to consider what is warranted to become policy. There have been a few general concussion policies put forth in Canada, including Private Member's Bill C-566 from the 41st Parliament, and some are in place currently, such as Rowan's Law and Program/Policy Memorandum 158 in Ontario. To consider whether a focus on

concussion on women and girls should be added to the present policies, policymakers are advised to consult the current literature to inform evidence-based decisions. However, in the field of concussion, much is decided based on consensus as it is an evolving field with many unanswered questions, and that can make policy decisions challenging. Nonetheless, there currently appears to be reason to include an emphasis on women and girls in prevention (as with other populations). However, areas beyond prevention remain less clear in the current literature. Future policy may include a focus on women and girls relating to concussion policy, depending on the direction of future research findings and stakeholder input, within and beyond sport (e.g., in the arts and in domestic violence).