VISTA, Bonn, 2013

Autonomic Cardiovascular Control and Sports Classification in Paralympic Athletes with Spinal Cord Injury

Andrei Krassioukov MD, PhD, FRCPC
Professor, Div. Physical Medicine & Rehabilitation,
Scientist and Associate Director ICORD,
Department of Medicine
and
Christopher West PhD
Postdoctoral Fellow, ICORD,
University of British Columbia, Vancouver, BC, Canada

icord INTERNATIONAL COLLABORATION ON REPAIR DISCOVERIES
from cells to community:
solutions for spinal cord injury

CIHR IRSC Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

a place of mind UBC

Vancouver CoastalHealth Research Institute
Healthier lives through discovery

Wheelchair Rugby Classification

- Wheelchair Rugby is a sport for tetraplegic male and female athletes. Players are classed into one of seven classes: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.5, **depending on their functional ability.** The higher classes are assigned to those players that have higher functional levels and the lower class players are players with less function.

- There are three off the court components used to determine players' classification:
- Bench Test - a muscle test is performed on all upper extremity musculature, in addition to an examination of range of motion, tone and sensation.
- Functional Trunk Test - assessment of the trunk and lower extremities in all planes and situations, this may include a manual muscle test of the trunk muscles.
- Functional Movement Tests - pushing, turning, stopping, starting, holding your chair against resistance, dribbling, passing, rimming and transferring are some of the functional skills that may be evaluated.
- A player will also be evaluated on the court, while playing; to help determine which class he/she falls into.
- During the game, the total value of all the players on the court for a team cannot exceed eight points. This ensures that teams must field a mix of athletes of all functional levels.

Objectives

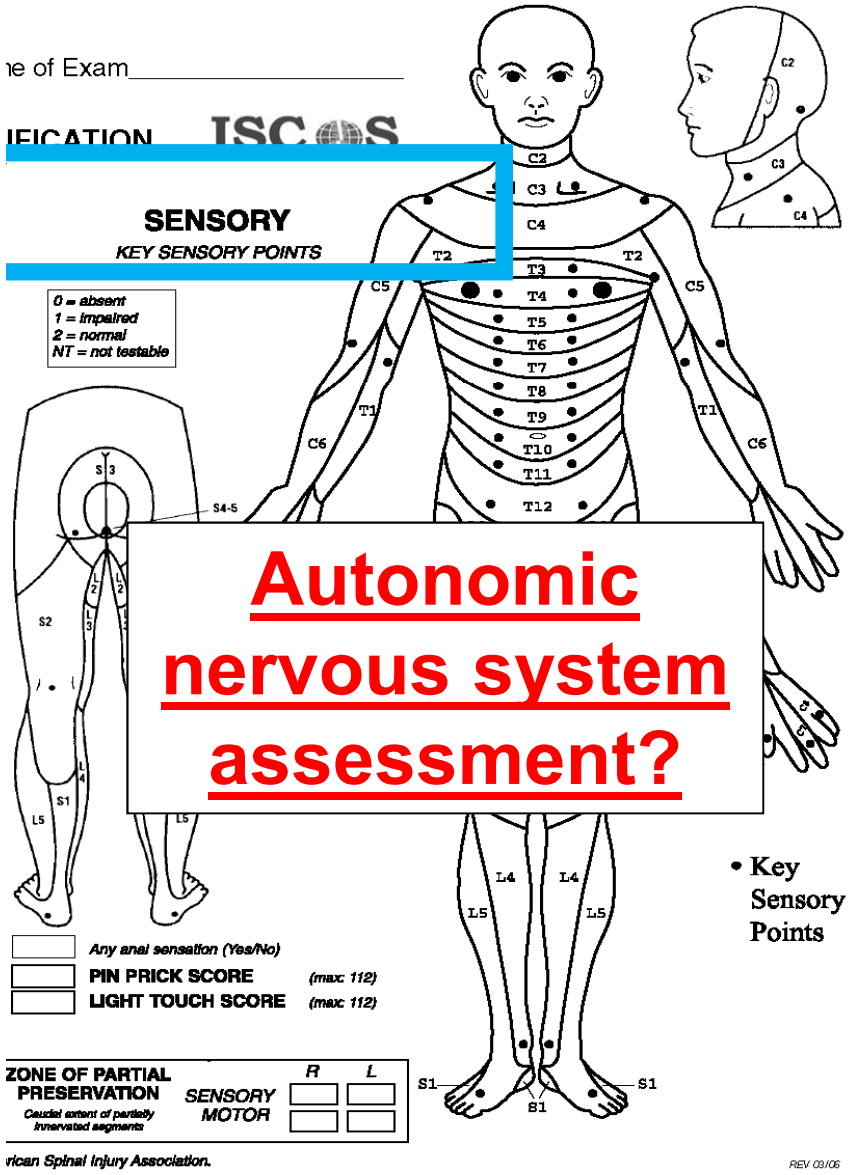
- To present a concept of clinical/neurological classification of spinal cord injury (SCI)
- To introduce concept of clinical AUTONOMIC classification of SCI individuals
- To describe association with cardiovascular control and Paralympics sport classification.
- To outlined future plans

Fight and flight response

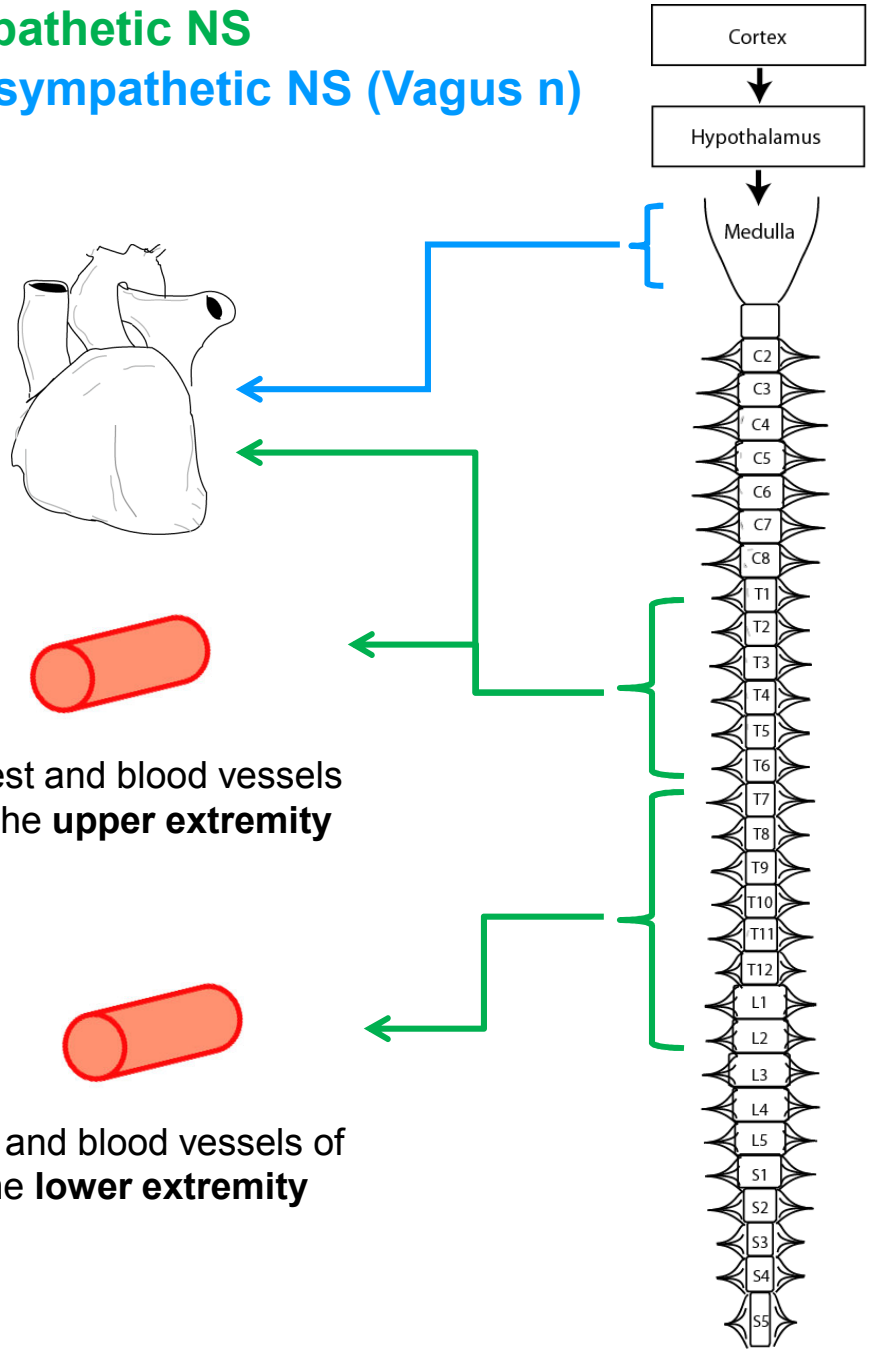
ASIA Impairment Scale. What is missing?

From ***Frankel*** scale (1969) to International Standards for ***Neurological*** Classification of ***Spinal Cord Injury*** (***ISNCSCI***) – ASIA Impartment Scale

1st edition 1982
2nd edition 1987
3rd edition 1889-90
4th edition 1992
5th edition 1996
6th edition 2000
7th edition 2011

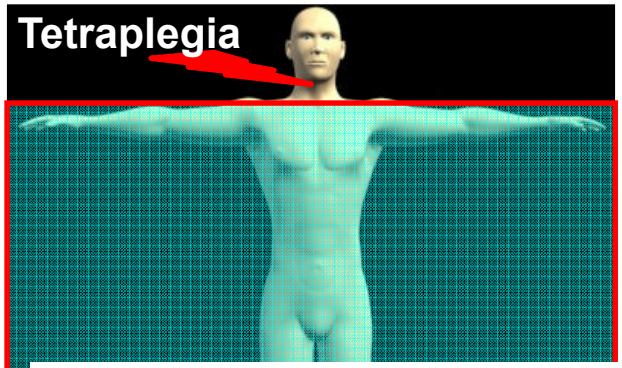


Sympathetic NS
Parasympathetic NS (Vagus n)

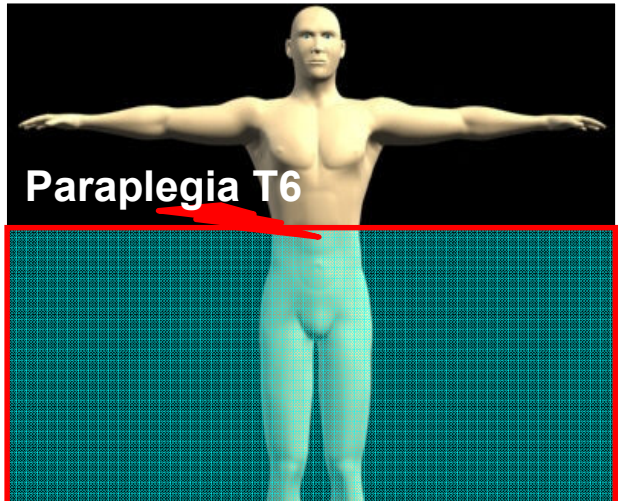


Chest and blood vessels of the **upper extremity**

Gut and blood vessels of the **lower extremity**



Neurogenic shock
Abnormal HR responses
Low resting blood pressure
Orthostatic hypotension
Autonomic dysreflexia
Loss of sweat response below of SCI



Orthostatic hypotension
Autonomic dysreflexia
Loss of sweat response below of SCI

Motor-Sensory completeness SCI versus **Autonomic** completeness SCI

2009. Introduction of the International Autonomic Standards

Page 1

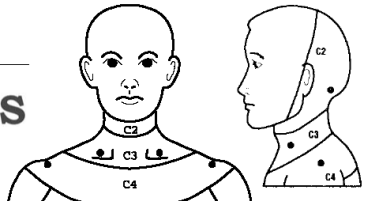
_____

_____ Date/Time of Exam_____

AMERICAN SPINAL INJURY ASSOCIATION

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

ISCoS



MOTOR **SENSORY**

KEY MUSCLES (scoring on reverse side)

	R	L		
C5	☐	☐	Elbow flexors	C2
C6	☐	☐	Wrist extensors	C3
C7	☐	☐	Elbow extensors	C4
C8	☐	☐	Finger flexors (distal phalanx of middle finger)	C5
T1	☐	☐	Finger abductors (little finger)	C6
				C7
				C8
				T1
				T2
				T3
				T4
				T5
				T6
				T7
				T8
				T9
				T10
				T11
				T12
				L1
L2	☐	☐	Hip flexors	L2
L3	☐	☐	Knee extensors	L3
L4	☐	☐	Ankle dorsiflexors	L4
L5	☐	☐	Long toe extensors	L5
S1	☐	☐	Ankle plantar flexors	S1
				S2
				S3
			Voluntary anal contraction (Yes/No) ☐	S4-5

UPPER LIMB TOTAL (MAXIMUM) ☐ (25) + ☐ (25) = ☐ (50)

Comments:

LOWER LIMB TOTAL (MAXIMUM) ☐ (25) + ☐ (25) = ☐ (50)

TOTALS ☐ (MAXIMUM)

NEUROLOGICAL LEVEL		R	L	COMPLETE OR INCOMP
The most caudal segment with normal function	SENSORY	☐	☐	Incomplete = Any sensory or motor functi
	MOTOR	☐	☐	ASIA IMPAIRMENT SC

This form may be copied freely but should not be altered withou

Autonomic Standards Assessment Form

Patient Name: _____

Anatomic Diagnosis: (Supraconal ☐, Conal ☐, Cauda E

Page 2

General Autonomic Function

System/Organ	Findings	Abnormal conditions	Check mark
Autonomic control of the heart	Normal		
	Abnormal	Bradycardia	
		Tachycardia	
		Other dysrhythmias	
	Unknown		
	Unable to assess		
Autonomic control of blood pressure	Normal		
	Abnormal	Resting systolic blood pressure below 90 mmHg	
		Orthostatic hypotension	
		Autonomic dysreflexia	
	Unknown		
	Unable to assess		
Autonomic control of sweating	Normal		
	Abnormal	Hyperhydrosis above lesion	
		Hyperhydrosis below lesion	
		Hypohydrosis below lesion	
	Unknown		
	Unable to assess		
Temperature regulation	Normal		
	Abnormal	Hyperthermia	
		Hypothermia	
	Unknown		
	Unable to assess		
Autonomic and Somatic Control of Broncho-pulmonary System	Normal		
	Abnormal	Unable to voluntarily breathe requiring full ventilatory support	
		Impaired voluntary breathing requiring partial vent support	
		Voluntary respiration impaired does not require vent support	
	Unknown		

Lower Urinary Tract, Bowel and Sexual Function

System/Organ	Score
Lower Urinary Tract	
Awareness of the need to empty the bladder	
Ability to prevent leakage (continence)	
Bladder emptying method _____ (specify)	
Bowel	
Sensation of need for a bowel movement	
Ability to Prevent Stool Leakage (Continence)	
Voluntary sphincter contraction	
Sexual Function	
Genital arousal (erection or lubrication) Psychogenic	
Reflex	
Orgasm	
Ejaculation (male only)	
Sensation of Menses (female only)	

2=Normal function, 1=Reduced or Altered Neurological Function
0=Complete loss of control NT=Unable to assess due to preexisting or concomitant problems

International Standards on documentation of remaining Autonomic Function after SCI (ISAFSCI)

1st edition 2009
2nd edition 2012

Date of Injury_____ Date of Assessment:_____ Examiner:_____

This assessment should use the terminology found in the International SCI Data Set (ASIA and ISCoS (http://www.asia-spinalinjury.org/bulletinBoard/dataset.php)

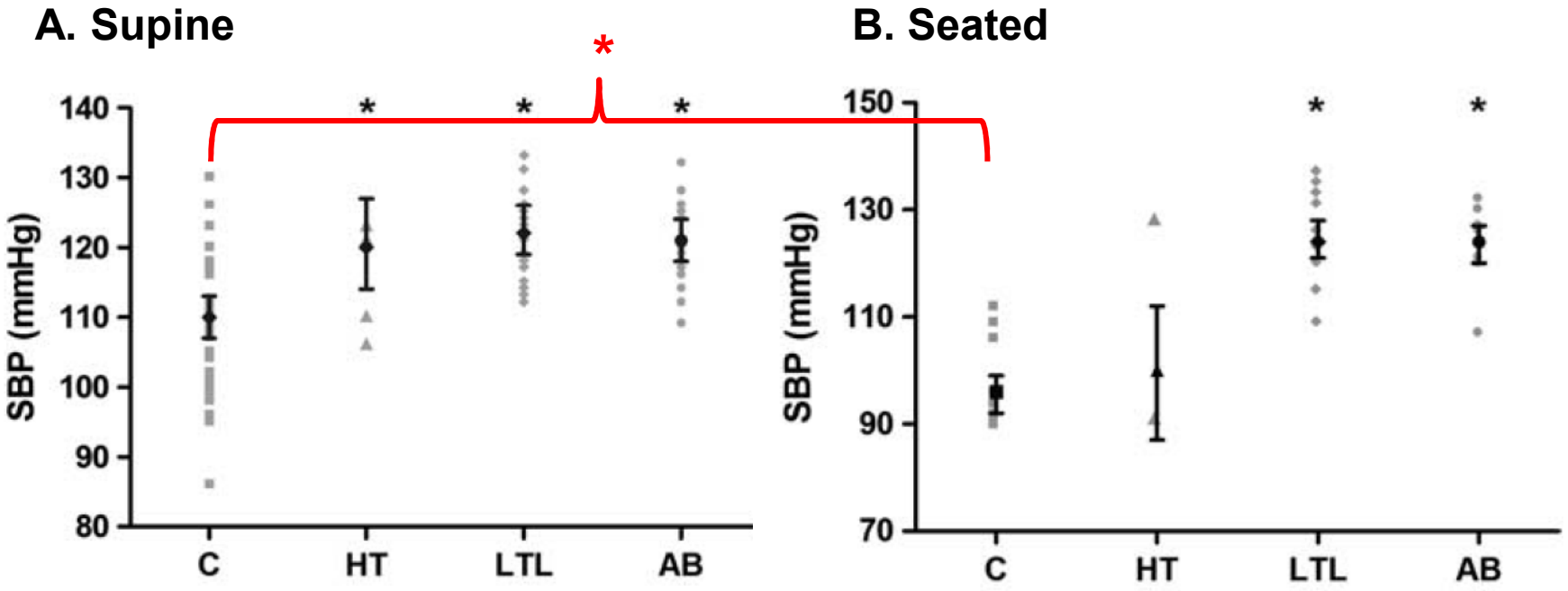
Spinal Cord (2012) 50, 484–492

www.nature.com/sc

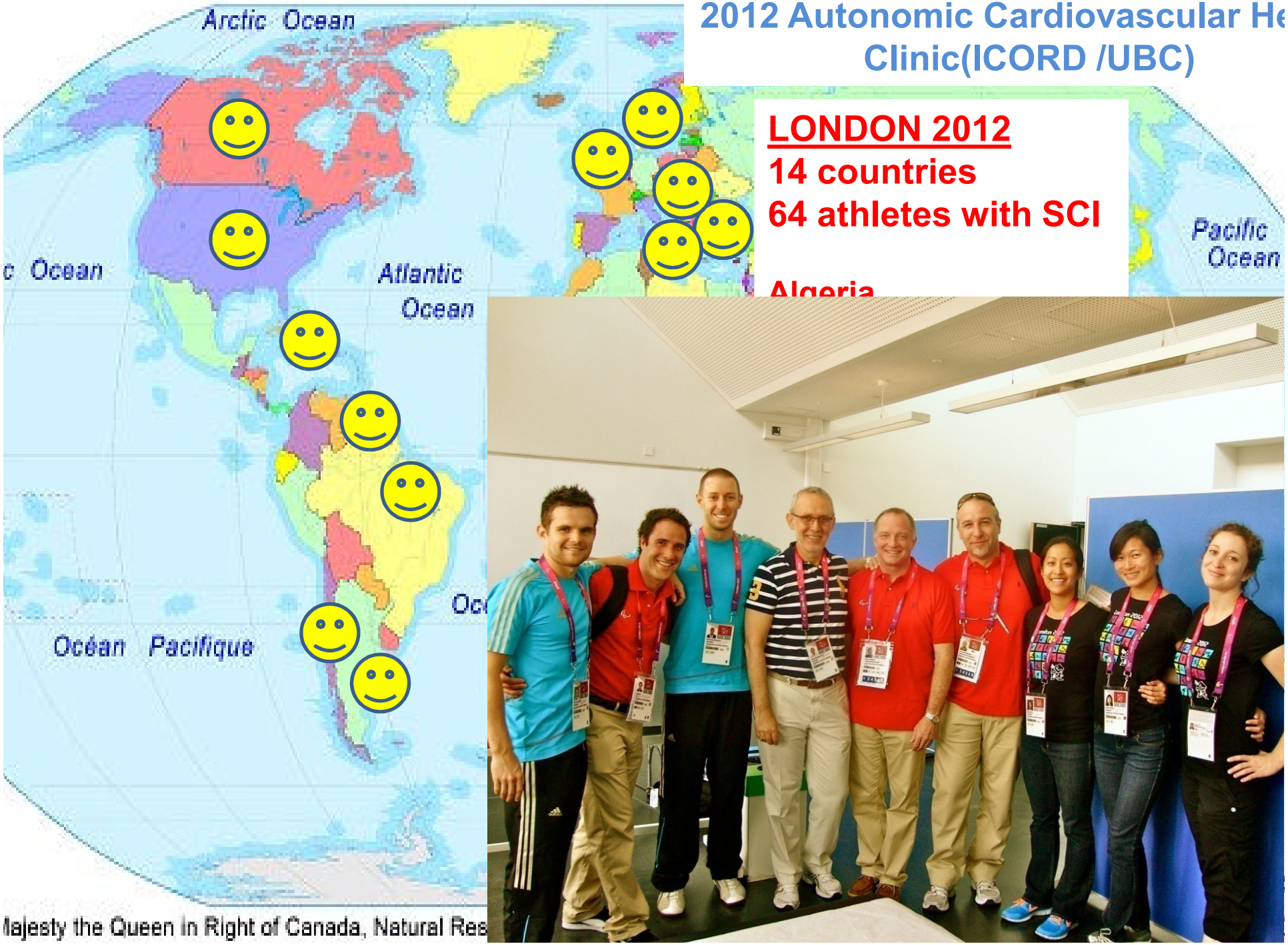
REVIEW

Influence of the neurological level of spinal cord injury on cardiovascular outcomes in humans: a meta-analysis

CR West[1,4], P Mills[1,2,4] and AV Krassioukov[1,2,3]



2012 Autonomic Cardiovascular He
Clinic(ICORD /UBC)



LONDON 2012

14 countries

64 athletes with SCI

Algeria

Take home message:

- We need further research and validation of our present data with respect to a possible addition of autonomic testing to the current functional Paralympic sport classification.

- We believe that only a few sports could benefit from this addition.

- We hope to continue working closely with the IPC on our mandate to educate Paralympic athletes about cardiovascular health after SCI, including the possible harmful effects of boosting and autonomic dysreflexia.

Acknowledgements:

Paralympics clinic was supported

Ms. Katie Oster
Mr. Edward Milligan
Mr. David Hawksworth
Mr. John Haythorne
Mr. David Doig
Dr. Stacy L. Elliott
Ms. Cheryl A. Niamath
Mr. David Carlin
Dr. Debra Van Aggelen
Panorama Village Medical Clinic
Mr. & Ms. Aleksander and Irina Getman
Drs. Rajiv and Stasy Reebye
Dr . S. Strovski
Dr. Olga Von Lipinski
Dr. Thomas W. Oxland
Dr. Lowell T. McPhail
Dr. Andrei Krassioukov