a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

Autonomic cardiovascular control in Paralympic athletes with spinal cord injury

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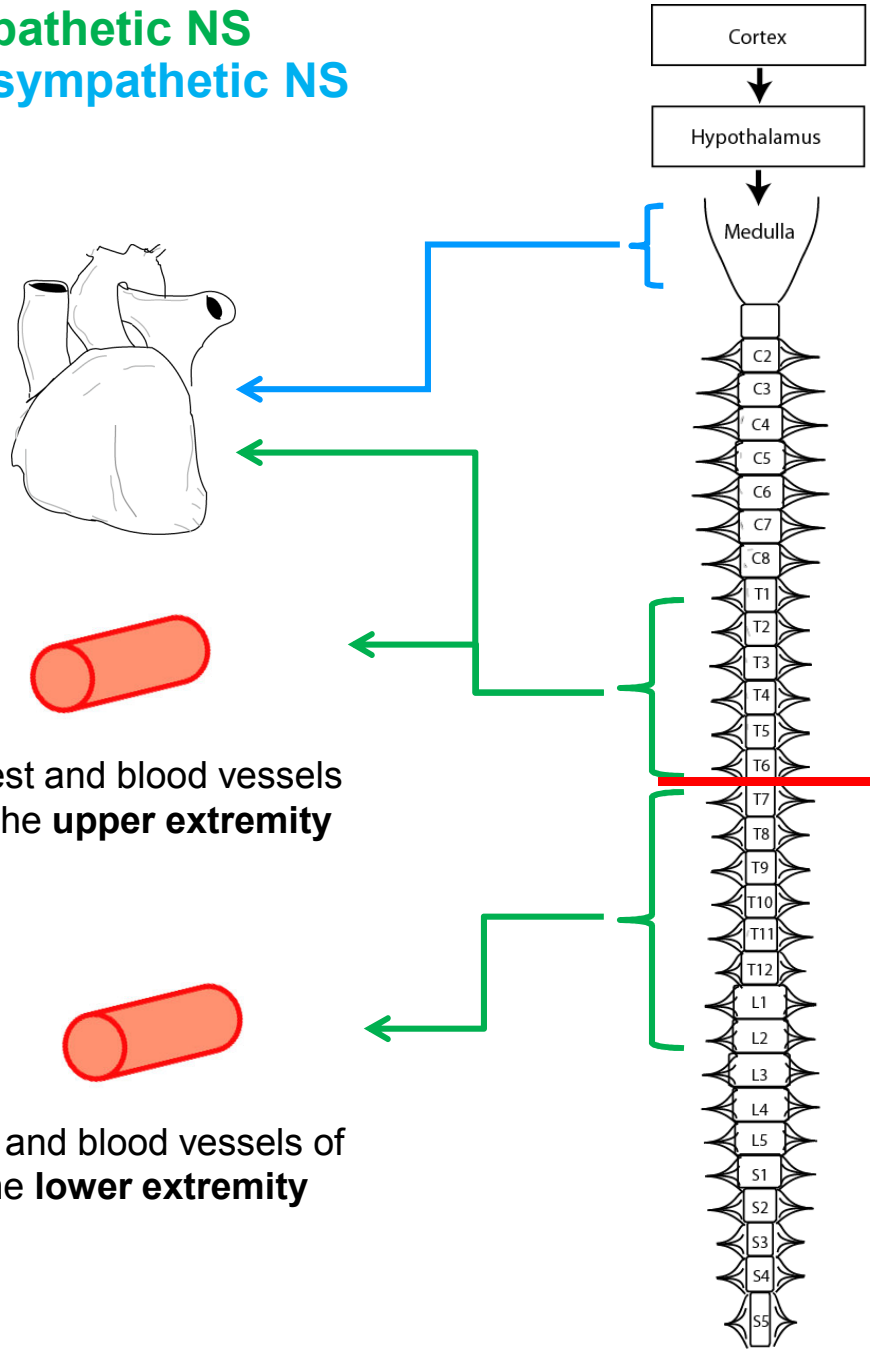
CARDIOVASCULAR HEALTH EDUCATION CLINIC

CRAIG H. NEILSEN FOUNDATION

icord INTERNATIONAL COLLABORATION ON REPAIR DISCOVERIES

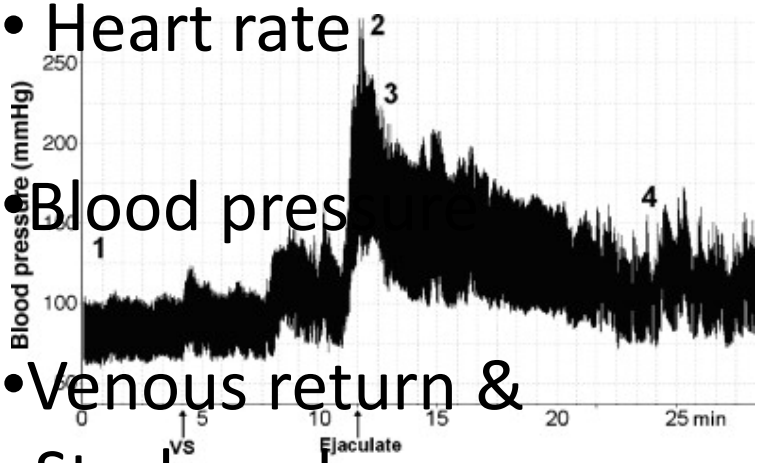
Sympathetic NS
Parasympathetic NS



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

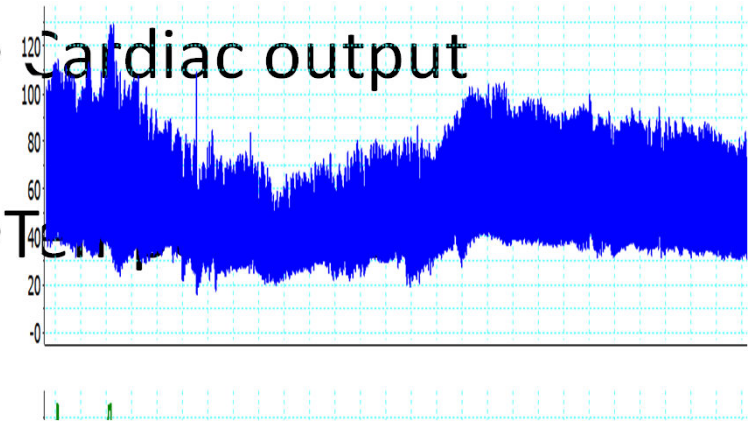
Gut and blood vessels of the **lower extremity**

- Heart rate
- Blood pressure
- Venous return & Stroke volume

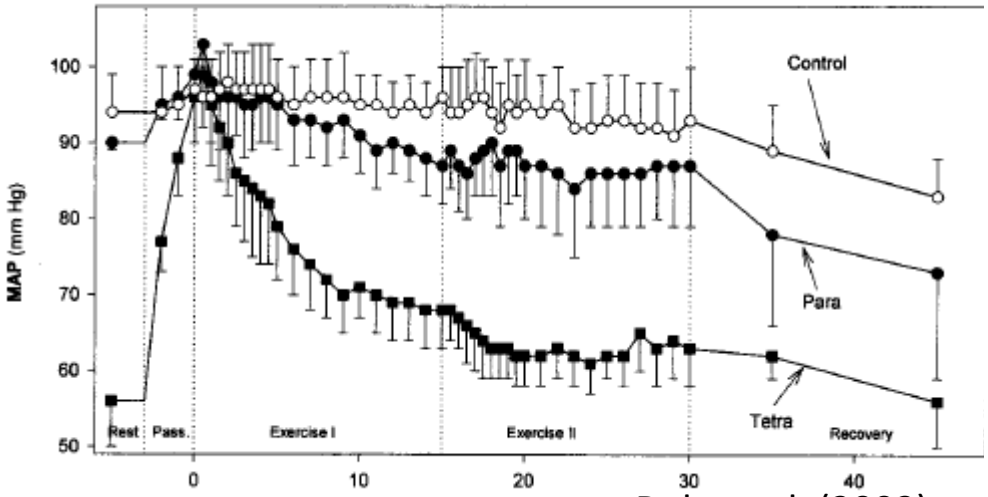


Krassioukov et al., (2009); Resp. Neurobiol & Physiol; 157-164

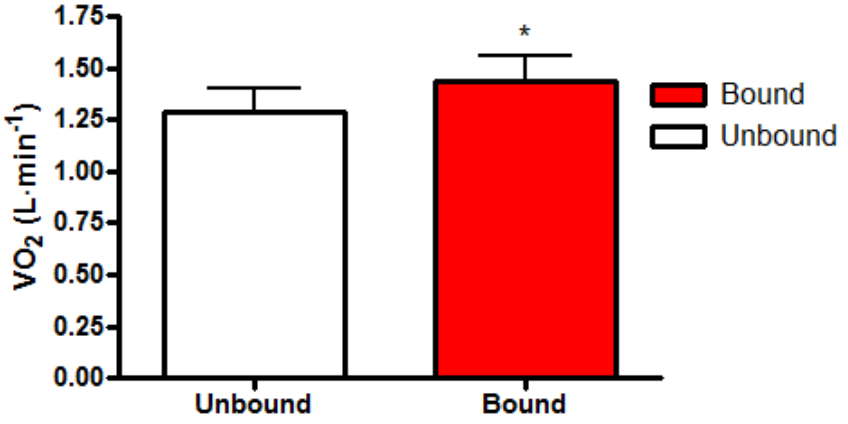
- Cardiac output
- T

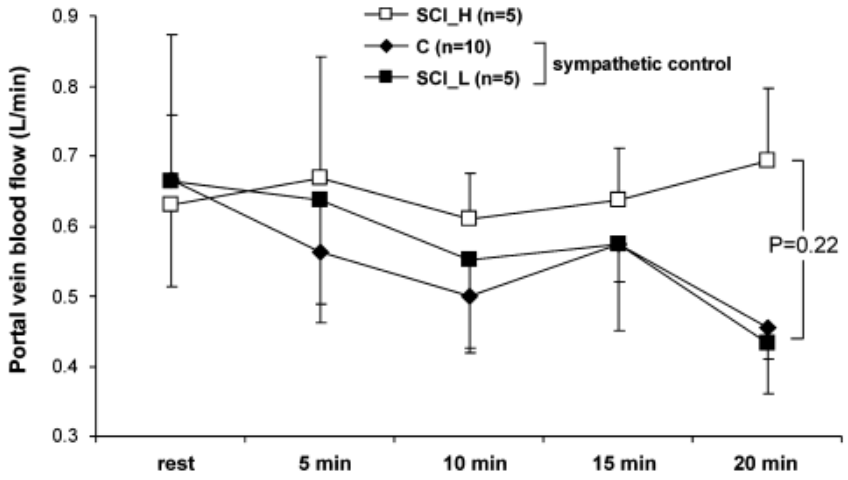


Cardiovascular function during exercise

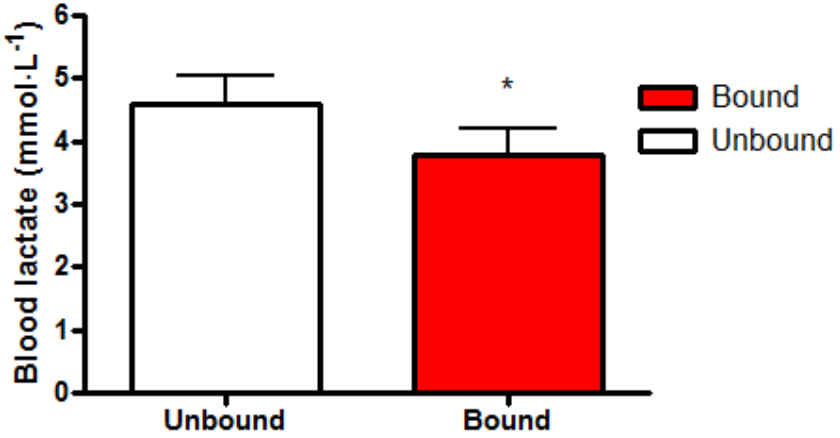


Dela et al. (2003)



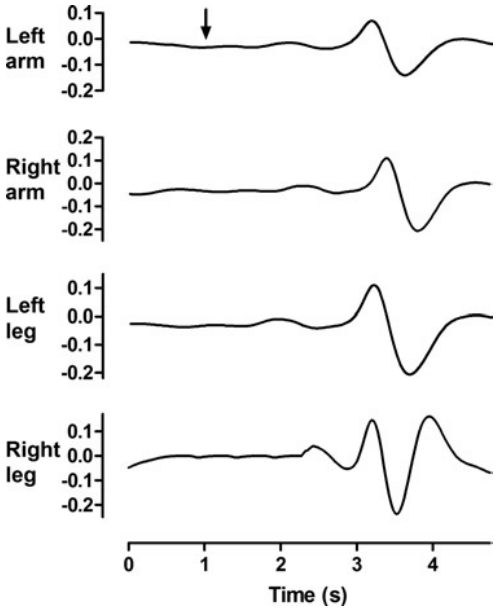


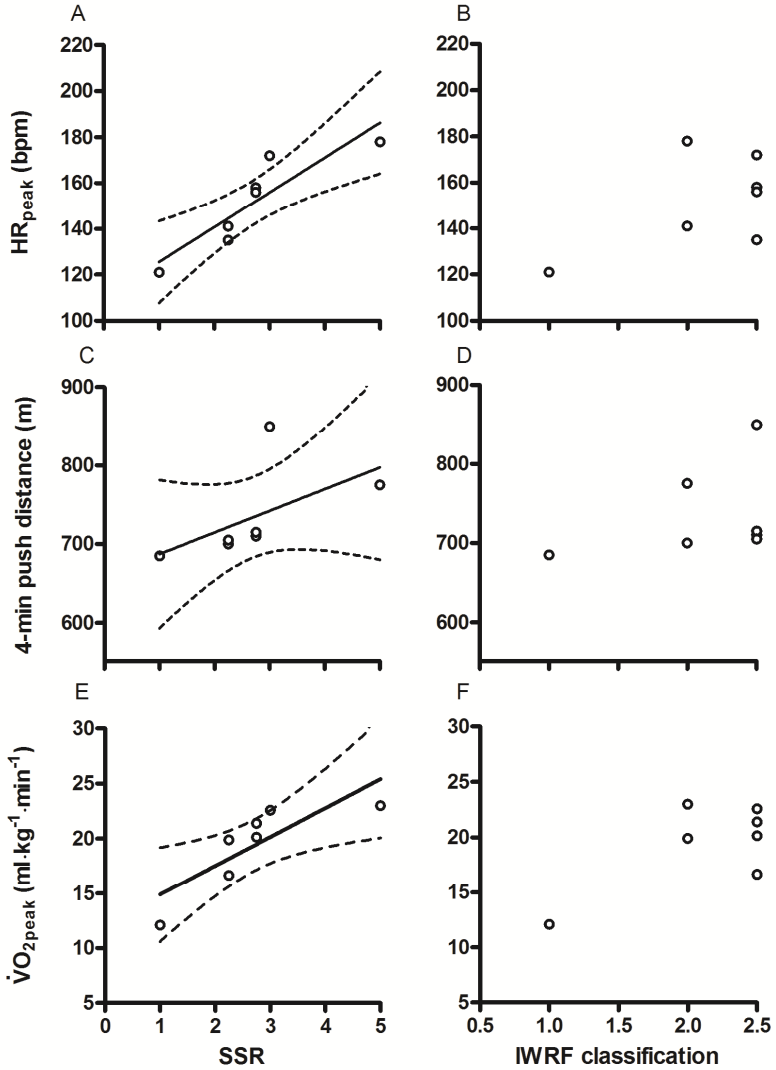
Thijssen et al. (2009)



West et al., under review

Autonomic cardiovascular control and exercise performance





West *et al.* (2013) Medicine and Science in Sport & Exercise; Feb;45(2):261-7

Interim summary

- Spinal cord injury elicits a lesion-dependent impairment in resting cardiovascular function
- Paralympic athletes with cervical/high-thoracic SCI exhibit impaired cardiovascular control during exercise
- Markers of exercise performance are accurately predicted by the degree of remaining autonomic control after SCI

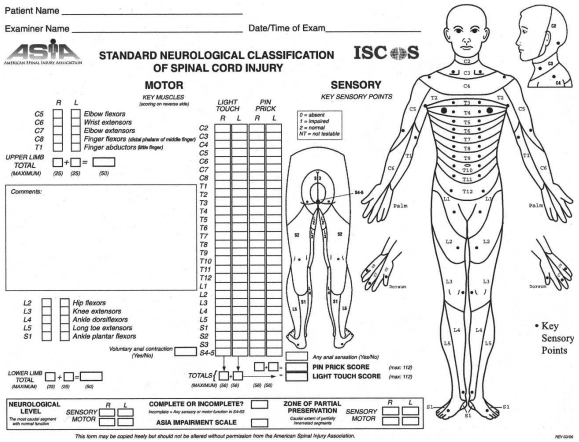
Autonomic control in Paralympic athletes with SCI – Lessons from the London2012 Paralympics

- **Sample:** 57 Paralympic athletes from 14 countries with chronic SCI (C2-L2) were recruited

- **Location:** Cardiovascular Health Clinic at the London2012 Paralympics

Methods

- Neurological evaluation
- Blood pressure response to sit-up
- Autonomic function via sympathetic skin response


Patient Name

Examiner Name Date/Time of Exam

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

ISCOS

MOTOR

KEY MUSCLES

SENSORY

KEY SENSORY POINTS

LIGHT TOUCH

PIN PRICK

Comments:

Hip flexors
Knee extensors
Ankle dorsiflexors
Long toe extensors
Ankle plantar flexors

Voluntary anal contraction (Yes/No)

Any anal sensation (Yes/No)

PIN PRICK SCORE (max: 112)

LIGHT TOUCH SCORE (max: 112)

NEUROLOGICAL LEVEL

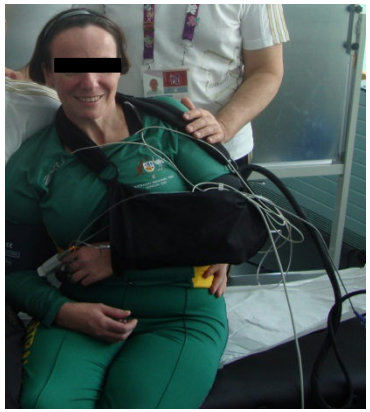
COMPLETE OR INCOMPLETE?

ZONE OF PARTIAL PRESERVATION

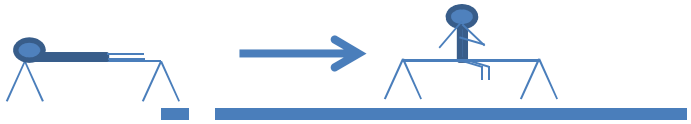
ASIA IMPAIRMENT SCALE

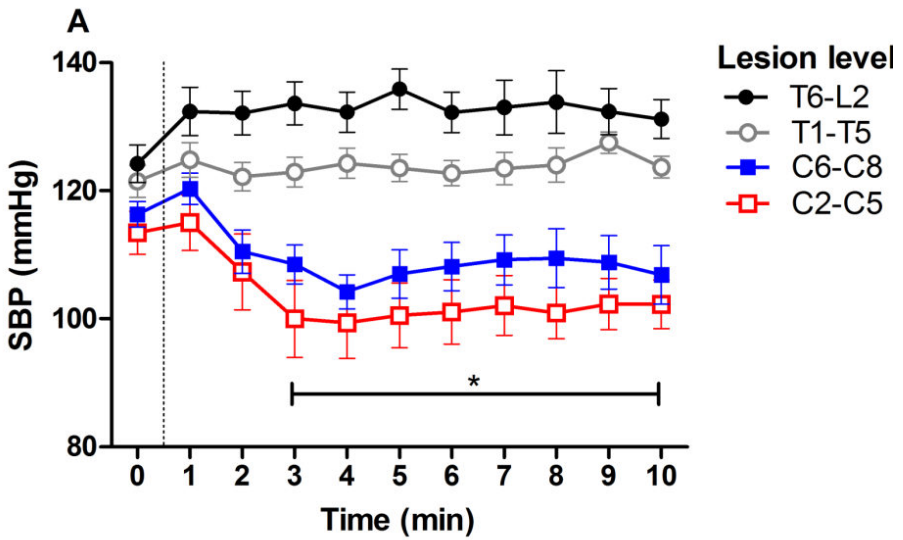
• Key Sensory Points

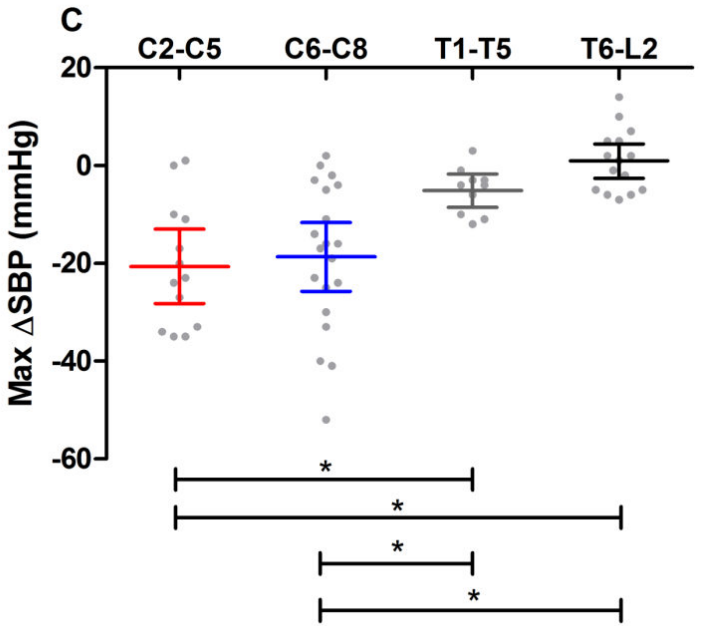
This form may be copied freely but should not be altered without permission from the American Spinal Injury Association.



Results

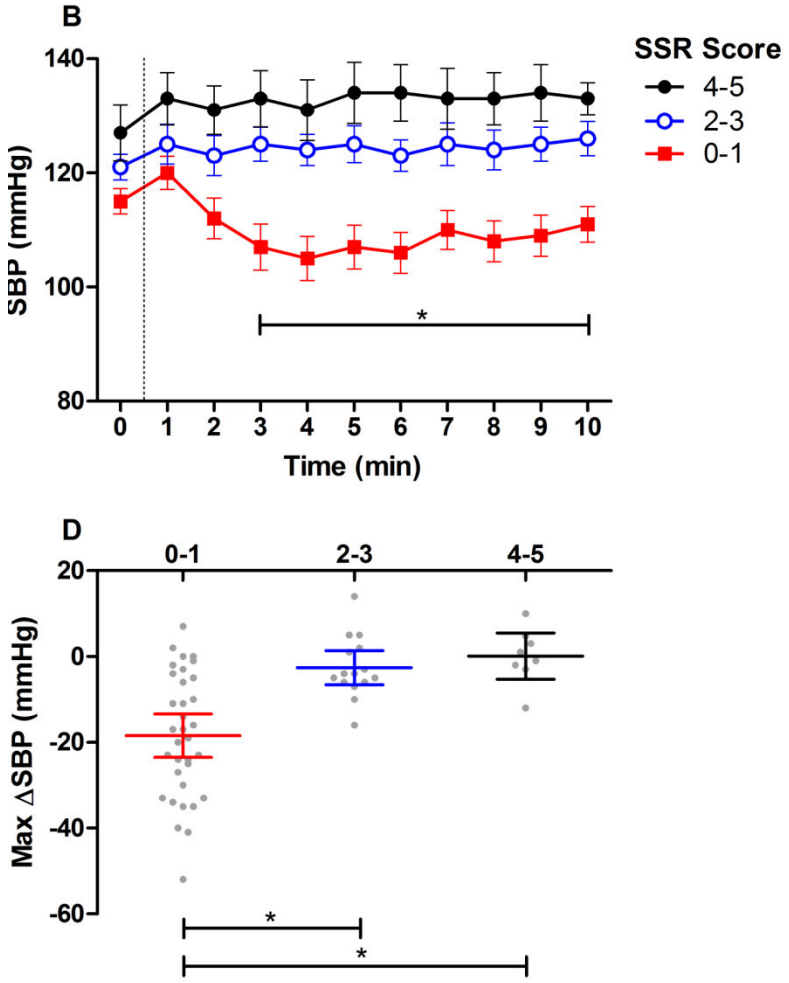






West *et al.* (Under review) Medicine and Science in Sport & Exercise

Results



	B	SE	CI (L,U)	p value
Seated SBP (0.64)				
Level of Injury				
T6-L2	Ref			
T1-T5	−6.8	4.9	−16.6, 3.0	0.135
C6-C8	−18.3	5.7	−28.0, −6.1	0.003
C2-C5	−26.9	5.8	−36.8, −13.1	0.000
SSR score				
4-5	Ref			
2-3	−7.6	4.9	−17,6, 2.3	0.130
0-1	−12.9	5.9	−24.7, −1.0	0.035

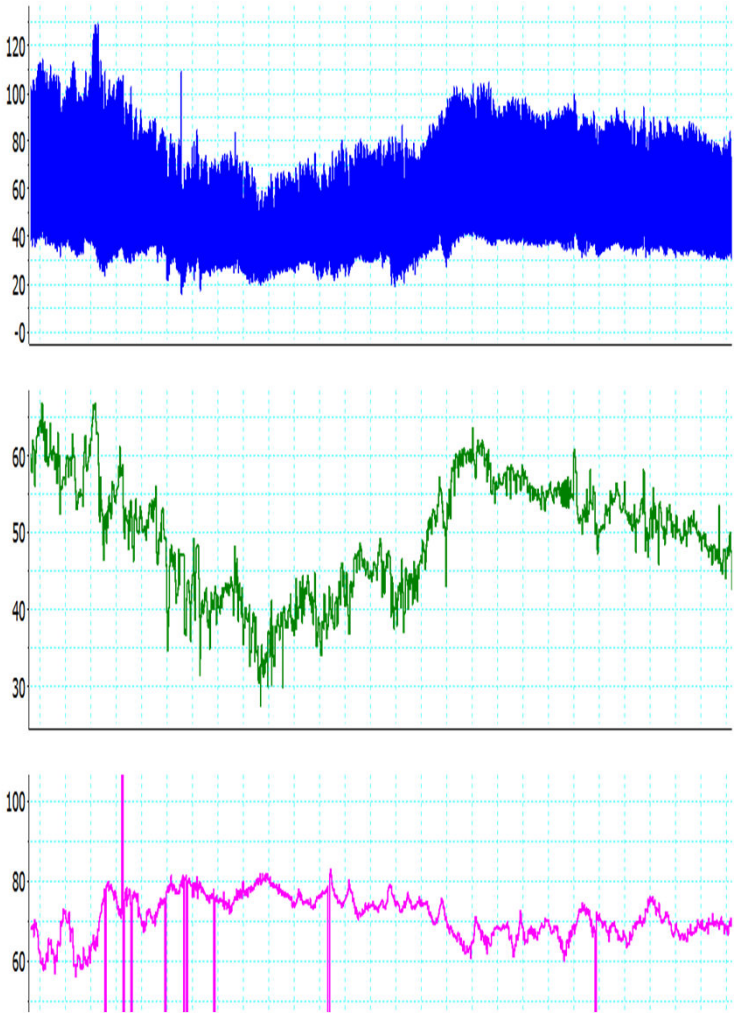
West *et al.* (Under review) Medicine and Science in Sport & Exercise

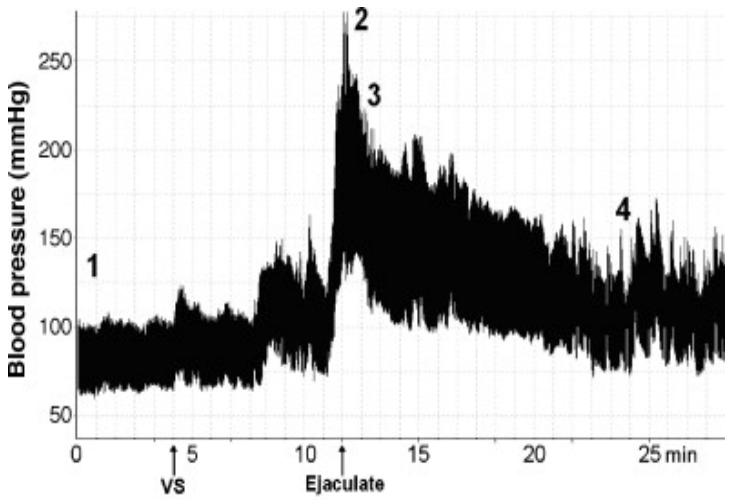
Results

	Autonomic Complete	Autonomic Incomplete
Total sample (n=44)		
Motor/Sensory Complete	11	16
Motor/Sensory Incomplete	10	7
Cervical only (n=21)		
Motor/Sensory Complete	8	1
Motor/Sensory Incomplete	10	2
Thoracic only (n=24)		
Motor/Sensory Complete	3	5
Motor/Sensory Incomplete	0	15

Autonomic completeness of injury agrees with neurological completeness of injury < 50% of the time

Implications for athlete health





Krassioukov et al., (2009); Resp. Neurobiol & Physiol; 157-164

Conclusion

- We demonstrate for the first time that assessment of lesion-level and autonomic completeness of injury provides the optimal combination to identify those at risk of abnormal cardiovascular control after SCI.

- We also demonstrate for the first time that SCI-induced differences in autonomic cardiovascular control are not reflected in the current clinical classification of Paralympic athletes.

- These findings suggest that more attention should be directed towards autonomic classification within wheelchair sports.

Acknowledgements

Research Team

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