Orthostatic Hypotension Among Elite Wheelchair Athletes

by David Mikhail, B.Sc. and Dr. Andrei Krassioukov

SLIDES	CAPTION
1	Before we begin, I would like to formally define our topic for those who are unaware – "Orthostatic Hypotension" is a form of hypotension (low blood pressure) which involves a drop of 20 mmHg systolic and/or 10 mmHg diastolic blood pressure after a change from a supine position to an upright position.
2	This presentation has three objectives which are written here.
3	**Q: What do you do to prepare your body to exercise?** **A: NOTHING!** Your sympathetic nervous system does it all for you! It controls your increase in heart rate, blood pressure, peripheral blood flow and respiration so as to fuel your body and muscles with what they need to perform. But what happens when you **DON'T** have a fully-functioning sympathetic nervous system?
4	For people with spinal cord injury (SCI), this is unfortunately a reality! They have been found to have all of the cardiovascular problems listed here and more. As you can imagine, if you can't get your heart and cardiovascular system pumping enough blood in your body, this can have a huge effect on your athletic performance and endurance – a daunting reality for a paralympic athlete. This can encourage athletes to use what is called **"boosting"**, which is basically when they induce tachycardia and autonomic dysreflexia in themselves by various methods, often endangering their health to improve their performance. **Autonomic Dysreflexia =** period of very high BP which can have mild symptoms such as sweating and headaches, but could lead to severe problems such as cerebral hemmhoraging and seizures!
5	This is just a list of the Paralympic games (summer and winter sports).
6	This slide gives us an idea of how Paralympic athletes are currently classified. For this first part of the study we looked at wheelchair rugby players. Currently, they are put through four tests: 1) Bench Test – tests their ball-handling ability 2) Functional Trunk Test – tests their trunk stability in their chair 3) Functional Movement Test – tests their overall maneuver abilities with their chair 4) On-Court Evaluation – tests their overall ability to play the game They are classified into one of 7 classes (above): **0.5 =** has poor motor hand-ball control and difficulties with trunk stability and ability to move with the wheelchair **3.5 =** has full motor capacity to control the ball and full stability in the wheelchair because of trunk strength **NOTES:** ***The significance of these scores is that any team can have a TOTAL SCORE of 8.0 on the court at any time between the four players on the court*** ***If you haven't noticed, this whole classification system is based completely on MOTOR function of the athletes and does not look at their autonomic nervous system function at all (which we have established controls the cardiovascular response during exercise)***
7	Above is a list of cardiovascular problems which are seen with SCI patients because of

	decreased cardiovascular function. Once again, I want to emphasize that the current classification (last slide) does NOT include autonomic function, which puts certain athletes (especially those with SCI) at a distinct advantage or disadvantage compared to others since this affects their ability to participate, their endurance and their performance level. **Note:** **We are specifically talking about those with SCI and not other types of wheelchair athletes (i.e. amputees or those with spina bifida).**
8	Basically, our study is aimed at developing a validated system for functional autonomic assessment and how to incorporate this into Paralympic classification by better understanding how autonomic function varies by injury and across various sports.
9	This is a breakdown of our wheelchair rugby participants. Note that most of the athletes had a cervical SCI and had a reasonably high classification.
10	The subjects were given an **"orthostatic sit-up test"**. Basically, we take a continuous ECG (ecocardiogram) and finometer blood pressure reading while the athlete is lying down at rest for 10 minutes, and then we sit him up in the chair (without the use of their own muscles). The athlete was also given a sympathetic skin response test, given a questionnaire about their symptoms and asked about symptoms during the tests. Here we are presenting data on the **cardiovascular parameters**. **Note:** The standard test to evaluate autonomic dysfunctions is usually the "**Tilt Test"**, but we did **NOT** use that test because **the athletes compete in a seated position and we wanted to test them under the same position. The orthostatic sit-up test was validated in our laboratory in previous studies.**
11	**This slide summarizes the results of our study!** When we analyzed the data, we found a significant difference in cardiovascular responses between athletes with cervical complete injuries (n=10) and cervical incomplete injuries (n=12). Here we are looking at the average systolic and diastolic blood pressures of the athletes. **COMPLETE CERVICAL** (**left**) – on average, we see a significant drop in systolic blood pressure indicative of orthostatic hypotension upon sit-up. **INCOMPLETE CERVICAL** (**right**) – on average, there is only a slight drop in systolic blood pressure, but not significant enough for orthostatic hypotension. **Here we want to point out that the average classifications of both of these groups are almost identical (1.80 and 1.88 respectively), but the cardiovascular response is significantly different in both of these groups. This <u>reinforces the fact that the fact that the current classification system does not sufficiently account for differences in autonomic function and cardiovascular dysfunction and that it varies among athletes!</u>** ***overall, we observed symptoms of orthostatic hypotension in about 43% of the subjects, and many developed dizziness and lightheadedness upon set-up***
12	This shows that the two groups did not show a significant difference in the frequency of different symptoms which presented during the test.
13	To summarize our conclusions and directions: We found that there **is a need for autonomic function to be included in paralympic athlete classification to maintain fairness in competition and decrease pressure on athletes to use "boosting" techniques. By including autonomic function in classification, we can**

	increase or decrease individual's scores and allow for more fair gameplay. We hope to do more studies with more sports in the future (including these winter Paralympics in Vancouver, and wheelchair basketball players in the future) to better understand the best way to add to the classification system.
14	**Thank you for reading!** **I would like to thank the IPC (International Paralympic Committee) and DHRN (Disabilities Health Research Network) for support and funding of this project!** **As well, everyone involved and Dr. Andrei Krassioukov.**