Medications, Boosting, and Other Dangerous Practices Used by Paralympic Athletes

Cheri A. Blauwet, MD

Assistant Professor in PM&R and Sports Medicine
Harvard Medical School
Chair, International Paralympic Committee (IPC) Medical Committee
Board of Directors, United States Olympic Committee
Member, IOC Medical and Scientific Expert Group
Outline – Medications, Boosting, Dangerous Practices Used by Paralympic Athletes

• Athletes are athletes, and athletes want to win

• Unique factors related to the para-athlete may create performance (and regulation) implications

• Examples of how this plays out:
  • Medication use patterns and TUE management
  • The problem of “boosting” in Paralympic sport
  • Emerging issue – use of botulinum toxin for spasticity management – or, performance enhancement?
  • Pushing the limits in environmentally tough conditions – example of para alpine skiing
Sport Regulation – Formal Code
TUEs and the Paralympic Athlete – Rio 2016

- **Rio 2016 Paralympics**
  - 155 applications
  - 4328 athletes
  - 3.58%

- **Rio 2016 Olympics**
  - 143 applications
  - 11,303 athletes
  - 1.27%
Unique Patterns of Medication Use

• Little evidence available – 2 prior studies
  • Tsitsimpikou et al, BJSM 2009 – Athens Paralympics
    – 64% of athletes declared meds or supplements
    – 81% fewer than 4 substances
    – 42% using supplements
    – 9.8% using NSAIDS (Olympics 11.1%)
    – 5.6% other analgesics (Olympics 3.7%)
  • Aavikko et al, CJSM 2013 – Finish Olympians and Paralympians

| TABLE 4. The Use of Physician-Prescribed Medications During the Previous 7 Days by the PAs and OAs |
|---------------------------------------------------|---|---|---|---|---|---|---|---|
|        | NSAIDS % (N) | Analgesics % (N) | Muscle Relaxants % (N) | Anti-Allergic Medication % (N) | Asthma Medication % (N) | Oral Antibiotics % (N) | Any Medication % (N) |
| PA (n = 92) | 16.3 (15) | 8.7 (8) | 5.4 (5) | 5.4 (5) | 4.3 (4) | 9.8 (9) | 48.9 (45) |
| OA (n = 372) | 6.7 (25) | 1.1 (4) | 0.3 (1) | 8.6 (32) | 11.0 (41) | 3.5 (13) | 33.3 (123) |
| OR (95% CI)* | 1.82 (0.77-4.22) | 11.23 (2.00-60.20) | 7.95 (0.79-80.45) | 0.62 (0.20-1.90) | 0.30 (0.10-0.96) | 4.10 (1.30-12.81) | 1.99 (1.11-3.51) |
| P, χ² | <0.05 | <0.05 | <0.05 | 0.35 | <0.05 | <0.05 | <0.05 |

*Logistic regression analysis after adjusting for age, sex, and PAs versus OAs.
Unique Aspects of TUE Management

- Certain prohibited substances show increased use, e.g.:
  - Population is slightly older
    - Beta blockers, diuretics
  - Athletes with polytrauma (i.e. veterans)
    - Testosterone replacement
  - Athletes with neuropathic pain
    - Opioids, cannabis
- Must strictly adhere to ISTUE
ISTUE 4.1.c – There Must Be No Reasonable Therapeutic Alternative

- Example – neuropathic/phantom pain in amputees

Consensus statement

International Olympic Committee consensus statement on pain management in elite athletes

Brian Hainline, Wayne Derman, Alan Verneč, Richard Budgett, Masataka Deie, Jiří Dvořák, Chris Harle, Stanley A Herring, Mike McNamee, Willem Meeuwisse, G Lorimer Moseley, Bade Omololu, John Orchard, Andrew Pipe, Babette M Pluim, Johan Ræder, Christian Siebert, Mike Stewart, Mark Stuart, Judith A Turner, Mark Ware, David Zideman, Lars Engebretsen

(Le Feuvre, 2014)
ISTUE 4.1.c –
There Must Be No Reasonable Therapeutic Alternative

• Example – neuropathic/phantom pain in amputees

<table>
<thead>
<tr>
<th>PHYSICAL AND OCCUPATIONAL THERAPY (in no particular order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Irritant Management: Attend to or highlight causes:</td>
</tr>
<tr>
<td>(dressings, infection, swelling, drug side effects,</td>
</tr>
<tr>
<td>prosthetic fitting, HO, neuroma, adhesions).</td>
</tr>
<tr>
<td>2. Application of compression to residual limb</td>
</tr>
<tr>
<td>(Juzo, tubifast, prosthesis)</td>
</tr>
<tr>
<td>3. Education and re-assurance (10)</td>
</tr>
<tr>
<td>4. Limb massage / De-sensitisation</td>
</tr>
<tr>
<td>5. TNS Machine</td>
</tr>
<tr>
<td>6. Physical Exercise</td>
</tr>
<tr>
<td>7. Scar Management</td>
</tr>
<tr>
<td>8. Graded motor imagery</td>
</tr>
<tr>
<td>9. Acupuncture</td>
</tr>
<tr>
<td>10. Cognitive Behavioural Therapy (CBT)</td>
</tr>
<tr>
<td>11. Heat / Ice</td>
</tr>
<tr>
<td>12. Relax Sock</td>
</tr>
<tr>
<td>13. Trigger Point release in the residual limb</td>
</tr>
</tbody>
</table>

(Le Feuvre, 2014)
Emerging Issue - Use of Botulinum Toxin

- Used by athletes with increased tone or spasticity
  - Ex: cerebral palsy, spinal cord injury

- Common lifelong management strategy for those with upper motor neuron syndrome
  - Blocks release of acetylcholine at the neuromuscular junction
    - Reduced spasticity
    - Reduced motor strength

- Can Botox be used post-classification to enhance performance?
## Nuanced Classification Guidelines

<table>
<thead>
<tr>
<th>Athletics T33</th>
<th>Athletics T34</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually quadriplegic or triplegic</td>
<td>Usually diplegic, minimal UE impairment</td>
</tr>
<tr>
<td>Mild spasticity in UE and asymmetry in propulsion</td>
<td>Minimal spasticity in UEs and symmetry in propulsion</td>
</tr>
<tr>
<td>Propulsion limitation in extension and follow through</td>
<td>Normal or close to normal follow through</td>
</tr>
<tr>
<td>Forward trunk movement limited by extensor tone during forceful pushing</td>
<td>Minimal limitation in trunk movements, although may be provoked with fatigue</td>
</tr>
</tbody>
</table>
**Ethical conundrum**
- Can we restrict an athlete’s right to enhance function with use of Botox?

**Resources conundrum**
- IPC: How to detect in efficient, cost effective manner?
- Athlete: Access to Botox exacerbates a socioeconomic divide

**More research is needed to determine level/degree of performance enhancement (if any)**
The Problem of “Boosting”

- Athletes with SCI ≥ T6 may experience autonomic dysreflexia

- Definition of boosting
  - Intentional induction of autonomic dysreflexia for performance enhancement

- May confer up to a 10% performance benefit

- Potential catastrophic health consequences
Boosting is Effective – Altered Physiology

• While in a boosted state:
  – Higher release of catecholamines
    • Norepinephrine > epinephrine
  – Higher peak power
  – Higher max BP and HR
  – Higher VO$_2$ max

• Most classic response is hypertension with reflex bradycardia

(Schmid, 2001)
Altered Physiology = Enhanced Performance

- **Boosting leads to:**
  - Up to a 9.7% improvement in 7.5K race time
    - Boosting: 22.6 +/- 6.6 min
    - Not boosting: 25.6 +/- 9 min

(Burnham, 1994)
Awareness is Low

• Anonymous survey of athlete knowledge and beliefs about boosting:
  - Only 56% of athletes surveyed had knowledge of the practice of boosting
  - 16.7% of athletes (all males) had boosted to improve performance
  - Only 25.5% felt this was “very dangerous” to health

(Bhambani, 2010)
IPC Testing Protocol

- **Athlete selection**
  - Selected at random off of heat sheets
  - Tested in 1st call room while being “checked in”

- **Implementation of test**
  - SBP used as proxy marker for dysreflexia
  - Goal BP ≤160 systolic via automated cuff
  - If above threshold, re-tested in 10 minutes
  - If remain above, pulled from competition
No Positive Tests, but Suspicious Cases

- **Example** - male competing in Athletics T52 100 Meter

- **Suspicious for a missed positive test**
  - Bradycardia with relative hypertension
  - Race time 5% faster for 100 Meter Prelim

<table>
<thead>
<tr>
<th></th>
<th>100 Meter Prelim</th>
<th>100 Meter Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP</td>
<td>176</td>
<td>104</td>
</tr>
<tr>
<td>DBP</td>
<td>97</td>
<td>58</td>
</tr>
<tr>
<td>HR</td>
<td>87</td>
<td>102</td>
</tr>
</tbody>
</table>
Systolic Blood Pressure in Athletes with SCI Pre-Competition

6 athletes
10 readings
Testing Protocol – Uses and Limitations

• Potential Considerations
  – Decrease in the prevalence of boosting?
  – Can boosting occur after testing is complete?
  – What about athletes with incomplete lesions?
  – Legal ramifications?

• Main goal - *to deter the practice of boosting through education and raising awareness, thus protecting athlete safety*
Dangerous Practices Related to Environmental Factors

• Travel factors – unique for the para athlete

• Athletes with limited mobility – difficulty with lavatory use → dehydration and risk of UTI

Illness by System (%) – Rio 2016

- respiratory: 10.8%
- digestive: 12.9%
- skin and subcutaneous: 32.7%
- genito-urinary: 17.8%
- diverse: 5.3%
Dangerous Practices Related to Environmental Factors

It’s a crazy world out there…
Dangerous Practices Related to Environmental Factors

Environmental conditions on field of play – Sochi 2014
Injuries in Sochi 2014

What have we learned? Let’s start with data...

2014 Paralympic injury and illness prevention study

The IPC injury and illness prevention study at the Sochi 2014 Paralympic Winter Games has the approval of the IPC Sport Science Committee and is supported by the University of Brighton, Faculty of Education and Sport Research Ethics and Governance Committee decision (FREGC/ES/12/11).

* 2014 WINTER PARALYMPIC GAMES: DAILY INJURY REGISTRATION

Thank you for participating in the 2014 Paralympic Games daily injury registration project.

Please enter your professional designation:

- Team Physician
- Polyclinic doctor
- Other doctor (Please Specify)
- Team physical therapist
- Polyclinic physical therapist
- Other physical therapist (Please Specify)
- Dentist
- Radiologist
Injuries in Sochi 2014

New development – sport specific mechanism of injury
Injuries in Sochi 2014

- Sochi Injury and Illness Surveillance
  - 100% of countries participated
    - 34/45 countries recorded on WEB-IISS (94.3% of athletes)
  - 174 injuries (24.5% of athletes)

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>IP (%) athletes</th>
<th>IR (per 1000 athlete days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All injuries</td>
<td>174</td>
<td>24,5%</td>
<td>26,5</td>
</tr>
<tr>
<td>Alpine / Snowboard</td>
<td>108</td>
<td>37,0%</td>
<td>41,1</td>
</tr>
<tr>
<td>Ice sledge hockey</td>
<td>41</td>
<td>24,0%</td>
<td>26,5</td>
</tr>
<tr>
<td>Wheelchair curling</td>
<td>10</td>
<td>14,0%</td>
<td>16,7</td>
</tr>
<tr>
<td>Bi-athlon / Cross country</td>
<td>15</td>
<td>10,1%</td>
<td>8,4</td>
</tr>
</tbody>
</table>
Injuries in Sochi 2014

<table>
<thead>
<tr>
<th></th>
<th>Upper part of course</th>
<th>Lower part of course</th>
<th>Finish area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Downhill</strong></td>
<td>13 / 8 DNF</td>
<td>5 / 3 DNF</td>
<td>3 / 1 DNF</td>
</tr>
<tr>
<td><strong>Super G</strong></td>
<td>3 / 2 DNF</td>
<td>2 / 2 DNF</td>
<td>2 / 2 DNF</td>
</tr>
<tr>
<td><strong>Combined</strong></td>
<td>3 / 1 DNF</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Giant Slalom</strong></td>
<td>2 / 1 DNF</td>
<td>2 / 1 DNF</td>
<td></td>
</tr>
<tr>
<td><strong>Slalom</strong></td>
<td>4 / 2 DNF</td>
<td>4 / 1 DNF</td>
<td></td>
</tr>
</tbody>
</table>

What factors made this such as dangerous race?
Course Setting

- **Wide (w)**: > 28 m
- **Medium (m)**: 26-28 m
- **Narrow (n)**: ≤ 26 m
- **Sinuous (si)**: > 6.3 m
- **Straight (st)**: ≤ 6.3 m
Para alpine downhill is a risky event…

But just how much risk, is TOO much risk?

Particularly for those of us entrusted with athlete health protection?
Critical changes to enhance injury prevention

- Appointment of independent race director with focus on safety issues and authority to postpone/cancel event
- Members of IPC Medical Committee on radio communication team for real-time decision making
- Course design widened and start line on section of course that avoids overly steep pitches; course to include “waves” instead of jumps
- Additional training runs for athletes
- Heavy focus in pre-Games technical and medical briefings
Re-Cap & Take Home Points

- The Paralympic Movement continues to grow at an unprecedented rate

- Controversies still remain

- Athletes will challenge our perspectives and biases
  - Athletes are athletes
  - Athletes will push the envelope

- The debate is crucial, and healthy
Thank You

International Olympic Committee
International Paralympic Committee
Harvard Medical School, Dept of PM&R/Sports Medicine
Fantastic mentors, friends and colleagues
References


Mills PB, Krassioukov A. Autonomic function as a missing piece of the classification of Paralympic athletes with spinal cord injury. Spinal Cord. 2011 Jul;49(7): 768-776


