



## International Perspective

# The Road to Rio: Medical and Scientific Perspectives on the 2016 Paralympic Games

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## Abstract

In August and September of this year, the world will turn its attention to Rio de Janeiro, Brazil, for the 2016 Summer Olympic and Paralympic Games. Of interest to physiatrists, the Paralympic Games will take place from September 7 to 18, with an estimated total of 4 billion viewers. In the United States, for the first time in history, the Summer Games will be broadcast over a total of 66 hours on NBCUniversal. The Paralympic Games represent the pinnacle of elite sport for athletes with disabilities while also changing perceptions around the importance of grassroots sport and physical activity opportunities for the disability community more broadly.

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It is no secret that the planning and preparation for the Rio Games has brought with it a number of challenges—the Zika virus, water quality, construction delays, and the oft-tenuous state of the Brazilian political system, to name a few. In some respects, these challenges are important as they stimulate discourse about the future of the Olympic and Paralympic Movement. In Paralympic sport, some of our current and most salient challenges are rooted in principles of sports medicine and science, as outlined herein. Because it is imperative to uphold the highest standards of athlete health and safety at the Games, this presents an unparalleled opportunity for the voice of physiatrists to come to the fore. As experts in disability and functional performance, neurologic and musculoskeletal rehabilitation, and sports medicine, we uniquely are suited to make an important and timely impact on Paralympic sport. Here, we provide a snapshot of what to watch out for in Rio.

## Prosthetic Use in Amputee Track and Field

The use of cutting-edge prosthetics in amputee sport initially gained global attention through the story of Oscar Pistorius—the first amputee to compete in both the Olympic and Paralympic Games

in London, 2012. Since that time, amputee athletes have sought to compete in both disability-specific and able-bodied sport, transcending stereotypes and perceived societal limitations. Most recently, a German long jumper and single below-knee amputee, Markus Rehm, has garnered international recognition. At the 2015 Doha International Paralympic Committee (IPC) Athletics World Championships, Rehm jumped a length of 8.40 meters, making him the new IPC world record holder [1].

Lesser known, however, is that this same jump would have made him a gold medalist at the London 2012 Olympic Games. In his attempt to compete in able-bodied track and field, Rehm recently underwent biomechanics testing at the German Sport University of Cologne. The results of the testing were inconclusive on whether he has an advantage over his able-bodied counterparts. Given that the International Association of Athletics Federations rules require him to prove that he has no advantage, he remains barred from able-bodied competition until further evidence is brought to the fore [2]. Looking ahead, it is clear that Paralympic athletes will continue to challenge concepts of what constitutes an appropriate, and fair, use of technology versus unfair performance enhancement. As with all cutting edge technologies, this pushes us out of our

comfort zone and begs the question—what will the future bring?

### Anti-Doping Challenges

Before the Olympic and Paralympic Games, doping in sport inevitably gains attention as athletes push the envelope to enhance performance, sometimes through the use of prohibited substances or methods. In Paralympic sport, issues related to an athlete's disability may, at times, lead to unique and complex challenges related to sample collection, the interpretation of results, and the granting of therapeutic-use exemptions that are central to conducting a rigorous testing program. For example, in 2014 a paper was published noting that several Japanese athletes had tested positive for glycerol—a substance that is prohibited, given its potential for use as a masking agent [3]. On further investigation, it was discovered that these positive tests were the result of the athletes' use of a glycerol-containing lubricant for self-catheterization [3]. Shortly thereafter, the World Anti-Doping Agency testing standards were adjusted to increase the urine threshold value that constitutes a positive test, making this error unlikely to occur in the future.

In the lead-up to Rio, all athletes have been cautioned against the use of glycerol-containing lubricants for urine sample collection. In addition, the Rio Paralympic village polyclinic and venue medical stations, as well as all doping control stations, will stock only lubricants that do not contain glycerol. As the performances of elite Olympians and Paralympians remain under scrutiny from an anti-doping perspective, considerations such as this, which uniquely impact athletes with a disability, must be taken into account to ensure fair and equitable competition.

### Use of Botulinum Toxin and Potential Impact on Classification

For physiatrists, it is commonly known that botulinum toxin is a standard treatment for spasticity caused by central neurologic injury such as cerebral palsy, traumatic brain injury, or stroke. Botox blocks the release of acetylcholine at the neuromuscular junction, thereby inhibiting the reflex muscle contraction that is the hallmark of spasticity [4]. From a functional standpoint, in appropriate candidates, therapeutic botulinum toxin may enable increased range of motion and reduce painful spasticity, however, a trade-off is motor weakness. In addition, from a global perspective, botulinum toxin is often seen as a "luxury" treatment that is readily available only within higher-resourced health care systems.

In Paralympic sport, concern has been raised regarding the use of botulinum toxin by athletes to unfairly improve performance. Currently, little objective

evidence exists to justify this claim, although it has prompted concern from athletes and coaches, particularly those from resource-limited settings. For example, a wheelchair racer with cerebral palsy who has not yet undergone treatment with botulinum toxin may be classified as a T33, characterized by mild upper extremity spasticity and resultant asymmetry in propulsion. Shortly thereafter, he/she maybe undergo treatment, and in follow-up, present with the function of an athlete in class T34, characterized by minimal upper extremity spasticity and symmetry in propulsion. Should this athlete be reclassified postbotulinum toxin injection? Under the current regulations in some sports, an athlete is to inform the Head of Classification of any medical intervention that may affect his or her impairment, in which case the athlete is requested to present for re-classification. There is a need, however, for further standardization.

In addition, because botulinum toxin currently is not a substance on the World Anti-Doping Agency Prohibited List, its use cannot be monitored objectively through the therapeutic-use exemption process. As medical and scientific leaders in Paralympic sport, we must be cognizant of these challenges and strive to uphold the rights of all athletes, including those from under-resourced regions throughout the Movement [5].

### Concussion and Its Impact on Paralympians

Concussion is a very important topic in sports medicine, with increasing resources being committed to the expansion of research, clinical care, and educational initiatives to potentially reduce its incidence and to provide better treatment paradigms. The next major update on concussion in sports science is expected at the 5th International Consensus Conference on Concussion in Sport, due to take place in Berlin in October 2016. Within this context and from a historical perspective, little attention has been placed on the unique needs of Paralympic athletes, for whom the risk of concussion in sport is of equal concern. Several categories of Paralympic sport, for example, those uniquely developed for athletes with visual impairment (eg, football 5-a-side) and those that take place at high speeds (eg, Para alpine sit skiing), show a particularly high incidence of concussion [6,7].

In addition, large portions of the Sport Concussion Assessment Tool, 3rd Edition, are not useful for athletes who use wheelchairs or with baseline balance deficits, and little is known regarding how the effect of concussion may be unique in athletes with central neurologic injury such as cerebral palsy, stroke, or traumatic brain injury. At the Rio 2016 Paralympic Games, the IPC Injury and Illness Surveillance Study will again be conducted to provide baseline epidemiologic data regarding injuries and illnesses in Paralympic sport, with a goal to reduce their incidence [8]. This

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