

High-performance sports medicine

Cathy Speed

ABSTRACT – High performance sports medicine involves the medical care of athletes, who are extraordinary individuals and who are exposed to intensive physical and psychological stresses during training and competition. The physician has a broad remit and acts as a ‘medical guardian’ to optimise health while minimising risks. This review describes this interesting field of medicine, its unique challenges and priorities for the physician in delivering best healthcare.

KEY WORDS: sport, medicine, high performance, elite, athlete

Introduction

Inspire a generation. The proposed legacy of the London 2012 Olympic and Paralympic Games is to ‘inspire a generation’ of young people to participate and take pride in their sport and to inspire a nation to be more physically active. It is also expected to have had a ‘seismic effect’ in shifting public attitudes to disability sports. The events of 2012 will also hopefully inspire a medical generation to recognise not only the broad remit of sport and exercise medicine physicians but also the relevance of high-performance sports medicine. This article reviews this field, describing the unique characteristics of the patient population, the roles and responsibilities of their physicians, and the challenges in delivery of best healthcare.

The patient

High-performance athletes compete at national or international level as ‘amateurs’ or professionals. These individuals are, by definition, extraordinary. The physical, physiological, psychological and behavioural attributes vary according to their sport. For example, elite rowers can have a lung capacity in excess of 11 litres (normal is 6 litres), and elite marathon runners can withstand hyperthermia and dehydration without significant detrimental effects on health and performance¹ and can cope with more than 150 miles per week of training. Athletes from endurance sports typically have oxygen uptakes of 85 ml/kg/min, compared with 50 ml/kg/min in a good club athlete.

Cathy Speed, consultant in rheumatology, sport and exercise medicine;¹ visiting professor of sports medicine;² senior physician³

¹Cambridge Centre for Health and Performance, Cambridge; ²University College Suffolk; ³English Institute of Sport

The role of the physician

Although genetic potential is fundamentally necessary, the route to athletic success includes intensive training from a young age. An endurance athlete may train for 45 hours per week for 15 years during their career. Such physical and psychological stresses can make an inherently resilient individual vulnerable to illness and injury. The role of the physician is to act as a medical guardian, minimising the risks and optimising the health of the athlete.² The International Olympic Committee (IOC) Medical Commission, formed in 1967, has a mission to protect the health and the welfare of athletes, ensure respect for medical and sports ethics, and achieve equality for all competing athletes.³ The health of the athlete prevails over the sole interest of competition and other economic, legal or political considerations. The IOC’s code emphasises the importance of maintaining the highest standards of medical practice and conduct of those healthcare providers involved. They must have the necessary training and experience in caring for athletes who are under extraordinary physical and emotional stresses in training and for competition. The physician plays an important role in the education of athletes, trainers and coaches, promoting the concept that a healthy body and a healthy mind are the keys to best performance.

The physician’s role typically involves leadership within a closely integrated interdisciplinary team. This team usually includes physiotherapists who act as rehabilitation and injury prevention specialists, nutritionists, strength and conditioning trainers, biomechanists, physiologists and others. The physician is almost always ‘on call’ and may have to facilitate care of an athlete who is training or competing halfway around the world. Communication strategies are key. Attention to detail is also vital: tiny margins define success or failure and any potentially reversible threat to health needs to be addressed.

Education and screening of athletes

Early health education of athletes and coaches and screening and prevention programmes represent important components of the physician’s remit. Regular ‘periodic evaluations’ – medical assessments – are carried out,⁴ and athletes will also go through specific elements of dedicated screening.

A challenge in high-performance sports medicine is understanding what is ‘normal’ for an athlete. Genetic traits and, in particular, the effects of intensive training can result in alterations in normal serum markers commonly assessed in medicine. For example, athletes may have higher values of serum aspartate aminotransferase (AST) from muscle due to training and high levels of alanine aminotransferase (ALT), mainly from the liver,

where haemolysis causes increases in bilirubin.⁵ Total creatine kinase (CK), CK from muscle and cardiac CK all can be increased significantly in a healthy athlete. As a marker of renal function, levels of creatinine can be inaccurate due to high muscle mass and protein intake; cystatin C could be a reliable alternative to creatinine.⁵

Most notable of all screening programmes is cardiac screening. The athlete's heart is still not well understood, but sudden cardiac death in young athletes is increasingly recognised. This was reviewed in a recent edition of this journal.⁶

Other medical issues in the athlete

A range of other clinical areas are common challenges in the care of high-performance athletes. Airway health issues are frequently encountered and can significantly impact on health and performance (see reference 7). Other important areas to highlight include underperformance syndrome, aspects of injury management and bone health concerns, psychological issues, doping control and the medical challenges of travelling.

Unexplained underperformance syndrome

Unexplained underperformance syndrome (UUPS) can affect up to 20% of elite endurance athletes, as well as athletes in other sports.⁸ The term UUPS has replaced 'overtraining syndrome' and describes fatigue and an unexpected sense of effort during training, and any history of heavy training and competition, frequent minor infections, myalgia, reduced sleep quality, loss of appetite and/or libido, depressed mood state and excessive sweating. Unexplained underperformance syndrome is a diagnosis of exclusion, so a thorough clinical assessment and investigation must be performed.

Bone health issues

High-impact physical activity has a well-recognised positive effect on bone health. However, low bone mass and related injuries are a particular problem in specific sports and have mixed and complex aetiologies, involving an interplay between low body mass, prolonged high-intensity training, energy deficit and/or eating disorders, and subsequent metabolic and endocrine consequences, including hypoleptinaemia and hypogonadism.⁹ Although bone health issues are more common in women, it is increasingly recognised that male athletes – for example, jockeys, lightweight runners and cyclists – are also at risk.¹⁰ Education of coaches and athletes on optimal body composition and nutrition and screening for behavioural disorders and bone health is vital in at-risk populations. The full effects of intense training on bone turnover markers, bone density at different sites and bone quality are yet to be fully established.

Injuries

Inevitably, musculoskeletal injuries typically represent two-thirds of acute medical cases in elite sports. Injuries may be sport specific and a thorough understanding of the demands of that sport by the physician is necessary to ensure best care. Sport-specific and individual-specific injury prevention programmes are a major focus of medical teams across all sports.

Psychological issues

Psychological problems in athletes are not uncommon and vary between sports and sexes (Fig 1). However, no evidence suggests that the incidence is any higher than in the general population.¹¹ Underperformance, anxiety and stress related to competition, and the effects of injury and illness are all common issues. Generalised anxiety and sleep disruption are the most common conditions and are more likely in women. Eating disorders are also more common in women. Most cases of depression are minor; the incidence increases with age.

Travelling

As most athletes travel regularly to train and compete, the role of the physician in the care of elite athletes can be nomadic. The effects of jet lag, travel fatigue and infectious illnesses on athletes are all common challenges. The physician often works in competition and training venues and must ensure good hospital facilities can be accessed, wherever the athlete is training or competing. Video conferences with the athlete and support staff are often necessary.

Doping issues

Of all medical issues in elite sport, the subject of doping is most widely discussed. Doping by athletes dates back to ancient Olympic times and continues to be a problem in the modern era. The risk to athletes' health from such practices was one factor in the establishment of the IOC's Medical Commission. The code

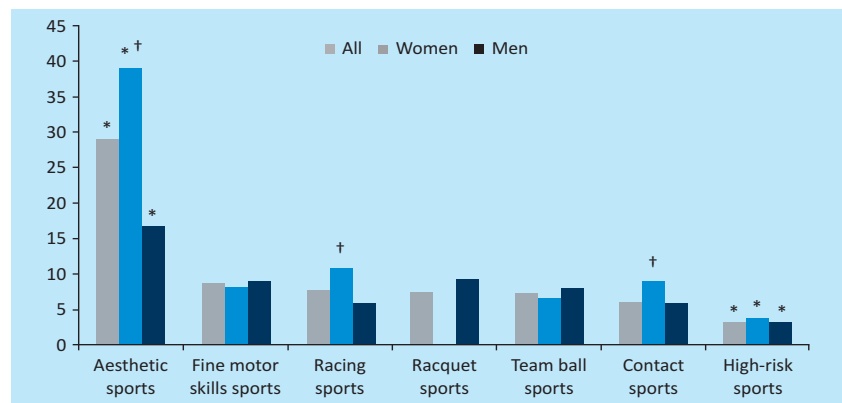


Fig 1. Lifetime prevalence (%) of generalised anxiety by type of sport played. *Significant difference with all other sports ($p < 0.05$). †Significant difference between men and women ($p < 0.05$). Reproduced with permission from Schaal *et al.* (2011)¹²

of the World Anti-Doping Agency (WADA), which was formed in 1999, clearly sets out banned substances and practices and is revised regularly to keep up to date.¹²

Athletes are educated from an early age about the importance of 'staying clean' and the wide and negative implications of doping.¹³ Athletes are responsible for ensuring that they respect and adhere to the WADA code. Any athlete who needs a prohibited substance for the sake of their health must obtain permission from their national doping agency with objective medical evidence.

Long-term health outcomes in high-performance athletes

Long-term intensive training in endurance (aerobic) sports and mixed aerobic and anaerobic sports is associated with reduced long-term morbidity and increased longevity; the outcomes in power athletes are less clear.¹⁴ However, there are also negative consequences. Arthritis from sport-related injury is widely acknowledged,¹⁵ and cognitive impairment from repeated concussion in high-contact sports is an increasing concern.¹⁶ The psychological consequences of retirement are frequently highlighted, although the athlete's professional development in this modern era typically includes planning and preparation for this inevitable event.

Clinical training in high-performance sports medicine

Physicians who wish to pursue a career in the regular care of high-performance athletes undergo specialty training, which includes some initial exposure to the clinical care of elite athletes.¹⁷ Further experience is gained through, for example, internships with teams and with sports governing bodies and other organisations, such as the English Institute of Sport.

Specialists from other fields who may contribute to the care of athletes will find that opportunities for continuing professional development (CPD) are increasingly available. These include dedicated journals, general congresses (for example, annual meetings of the British Association of Sports Medicine and American College of Sports Medicine) and conferences on specific aspects of care, such as those listed on the Royal College of Physician's events diary website (events.rcplondon.ac.uk) and the Faculty of Sport and Exercise Medicine website (www.fsem.co.uk). The IOC regular conference on the prevention of injury and illness in sport is also a useful educational meeting.

Summary

High-performance athletes are extraordinary human beings who are exposed to high physical and psychological stresses during their professional lifetimes. The medical care of these individuals presents unique challenges, often in unusual environments. The physician's role is one of medical guardianship, education and leadership in promoting and protecting the philosophy of a healthy mind in a healthy body in all athletes.

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**Address for correspondence: Dr C Speed, Progress, Cambridge Centre for Health and Performance, Conqueror House, Vision Park, Impington, Cambridge.
Email: cathy.speed@btinternet.com**