

Britain's anabolic steroid epidemic

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Tackling the growing misuse of anabolic-androgenic steroids will need multidisciplinary co-operation to reduce the risk of harm to those who abuse image and performance enhancing drugs.

Last year, *The Guardian*¹ reported that almost one million Britons inject or swallow exogenous anabolic-androgenic steroids (AAS), which refer to testosterone and its synthetic steroidal derivatives. This number is steadily growing and is likely to underestimate the real threat of misuse as individuals will frequently not want to disclose their AAS use. Persuading these patients to disclose their AAS use and educating them about the health concerns of their behaviour is a significant challenge in primary care.

It is suggested that the majority of AAS use in the UK is for cosmetic reasons, as opposed to enhancement of athletic performance.^{1,2} The typical user would be considered by society as fairly ordinary (for example, a 19-year-old male who wishes to optimise his physique inspired by reality TV shows; or, a 45-year-old male who needs an outlet from pressures at home and work; or a 62-year-old male who aims to recreate the care-free experiences of his youth). However, what most have in common is a desire for extreme masculinity and an increase in self-esteem.³

This article will explore the development of the AAS epidemic, along with the health risks associated



In the UK there is a continued increase in the number of people taking anabolic-androgenic steroids (AAS) for cosmetic reasons, with deleterious consequences to physical and mental health

with the drugs' misuse, and discuss how we, as healthcare professionals, can best deal with this issue in patients.

History of image and performance enhancing drugs

The use of image and performance enhancing drugs (I PEDs) started during the first part of the twentieth century through the isolation of testosterone in Germany.⁴ Over the past decades, there has been an unprecedented increase in misuse and abuse of I PEDs. Technological innovations driving progression in pharmacotherapy, coupled with the expansion of unregulated online services and societal factors, have also played a pivotal role in this.

I PEDs are categorised based on their reason for use. For example,

AAS promote growth of the skeletal muscle, development of male sexual characteristics in males and females, and can improve overall sense of wellbeing. Non-steroidal anabolics, such as insulin and human growth hormone, improve physical capacity. Weight loss drugs (eg sibutramine), cosmetic skin appearance drugs (eg Melanotan), sexual behaviour and function drugs (eg bremelanotide), cognitive function enhancers (eg methylphenidate) and drugs acting on mood to feel 'better than well' (eg fluoxetine) are also commonly abused I PEDs.⁴ While many of these drugs are regularly prescribed in a medical setting, this article focusses on non-prescribed substances of abuse.

AAS can be taken orally, injected intramuscularly, or applied to the skin

as topical lotions. Injectable forms cause less liver toxicity, but oral forms clear more quickly from the body in terms of drug testing.⁵ Recreational drug dosages are 10–100 times higher than prescribed ones for medical conditions, and their use can be in a pattern called ‘cycling’, which involves taking multiple doses of AAS over time, then stopping and restarting; or ‘stacking’, which is the mixing of different drug classes with different delivery systems (and may include compounds that are used in veterinary medicine); or ‘pyramiding’, where drugs are taken in a cycle of 6–12 weeks, starting slowly, peaking, tapering, then stopping abruptly before restarting the cycle; and finally ‘plateauing’, which is the staggering and substituting of drugs to avoid tolerance.⁶

Prevalence and user characteristics

Determining the prevalence of AAS use is challenging. Sagoe *et al* suggest that global lifetime prevalence for males and females combined is 3.3%, with higher levels in the UK and across Europe.⁷ Other studies estimate AAS use in up to 6.4% of men in the general population, and in 18.4% of male recreational athletes.⁸ Although the exact prevalence remains unclear, there seems to be consensus that numbers continue to rise. Monitoring in needle and syringe programmes has reported that up to 80% of clients attending are now AAS users, compared with <1% in the 1980s.⁹

In the UK, the majority of AAS users are males aged between 20–40 years; about 25% start using as teenagers.¹⁰ Systematic reviews have shown that AAS use is associated with low self-esteem, wanting to ‘take back control’, higher rates of depression and eating disorders, muscle dysmorphia, greater participation in sports where weight and body shape play a pivotal role,¹¹ and having been sexually abused in the past.¹² However, these are obviously associations and different user profiles do exist.

Adverse effects on health

The misuse and abuse of AAS can put health and lives at risk. The drugs are associated with deleterious side-effects, ranging from mild to life threatening, transient to permanent (see Table 1). The majority of data come from case reports rather than epidemiological studies¹³ that, while useful to some degree, warrants the publication of some higher level evidence. In one review 19 deaths were found in case reports published from 1990 to 2012, but causality could not be established due to polypharmacy and comorbidities.¹⁴

AAS use is associated with multiple cardiovascular problems, primarily mediated by an increase in low-density protein (LDL) and triglycerides, coupled with a decrease in high-density lipoprotein (HDL) within weeks of starting the drugs.¹⁵ For these effects to normalise after discontinuation of AAS can take months. Patients are at risk of incident/exacerbation of hypertension, arrhythmias, cerebrovascular events, coronary artery disease, heart failure and subsequently chronic kidney disease.^{2,15,16} These effects, as well as thromboembolic events (AAS predispose to thrombosis), are even seen in the young who have commenced taking AAS.¹⁷

Regarding hormonal and metabolic effects, ongoing AAS abuse causes steep increases in plasma androgen levels, ultimately facilitating hypothalamic-pituitary-gonadal (HPG)-axis suppression due to negative feedback mechanisms. This can lead to AAS-induced hypogonadism, with impaired spermatogenesis, testicular atrophy, reduced fertility, gynaecomastia and male-pattern baldness.¹⁸

AAS-induced hypogonadism frequently shows following AAS withdrawal due to sudden decreases in plasma androgen levels following AAS cessation.¹⁹ A recent study concluded that AAS-induced hypogonadism is common and prolonged (>1 year), and associated with significant morbidity when withdrawing.²⁰ This includes

reduced or absent libido, erectile dysfunction, fatigue, depression, and sometimes suicidality.¹³ Even without depression, the symptoms can be sufficient to prompt a re-starting of the AAS. The exact mechanisms of prolonged symptoms and signs experienced are complex and incompletely understood.⁸ Patients in a recent *Esquire* magazine article described their post-AAS state as agonising: ‘you feel like a small or lesser man’; ‘you feel like all your clothes are falling off but it is in your head’; and ‘three women could be bouncing naked in front of you on a trampoline and all you want is a cup of tea and a hug’.²¹ Clomifene and HCG can be used off-label by experienced clinicians and with appropriate monitoring in place to counteract severe symptoms where required.

Particularly if AAS are used in combination with insulin-like growth factor, there is an increased risk of testicular cancer.²² In women, AAS cause masculinisation with effects on breast size, skin and hair pattern, voice and body fat.²³

Other effects can be seen on the liver, the musculoskeletal system, and the skin (see Table 1).^{24–26} The use of AAS can further affect the mental health and behaviour of the user: AAS have been found to increase irritability and aggression,²⁷ although effects seem to be highly variable across individuals²⁸ and results may be confounded by over-represented personality traits.

Higher drug dosages have been linked to anxiety states and mood disorders, including mania and depression.²⁹ Moreover, AAS users are more likely to take other drugs such as cocaine, cannabis and opioids, which often serve to alleviate side-effects from long-term AAS abuse and/or weightlifting injuries.^{30,31} It has been suggested that pubertal exposure to AAS could lead to lasting structural brain changes, in particular in the hippocampus (learning and memory) and the amygdala (emotions).³²

A further issue is transmission of blood-borne viruses, such as hepatitis B/C and HIV, as well as local infections and gangrene from injecting. Recent studies have shown similar prevalence of these conditions in injectable IPEDs users when compared with users who inject psychoactive substances.³³

A further concern is the illicit drug trafficking of anabolic steroids.³⁴ In November 2019, the head of an international pharmaceutical firm was jailed in the UK for what is estimated to have been globally the largest illegal AAS production and distribution organisation. Of course, buying AAS

online from unknown sources/illicit drug manufacturers can lead to unexpected side-effects from contaminated drugs that may be variable in strength.⁷

Future steps and prevention

As demonstrated, AAS can have deleterious physical and mental health consequences, including addiction. The latter includes steroid dependence, and it is estimated that 32% of AAS users are dependent.¹⁰ Symptoms can include tolerance (needing higher dosages for similar effects) and withdrawal symptoms upon stopping (see previous section).

Although IPEDs (including AAS) differ from other drugs of misuse such as cocaine or heroin in that they do not produce an immediate euphoric high, users may still develop a substance misuse disorder, characterised by continued use despite adverse health consequences. A study presented at the 2019 European Society of Endocrinology meeting showed that many men continue to abuse AAS 'despite knowing that they have serious, life-limiting and potentially lethal side-effects'.³⁵

At present, there are no formally evaluated drug prevention interventions in relation to IPEDs in the UK.⁵ However, there are a growing number of AAS clinics within the NHS and privately. They vary in their offerings, ranging from needle exchanges and education, to interventions such as advice on nutrition and exercise plans as an alternative to AAS.

AAS intervention programmes might share building blocks with other drug misuse programmes, such as challenging beliefs and behaviour in relation to the drug taking. Additional areas to address may be how to manage cultural and media pressure regarding appearance, as well as self-esteem and self-efficacy training. At least part of the interventions could also be offered online: allowing easy access, and drawing in people who might otherwise not seek help due to

System	Problem
Cardiovascular	<ul style="list-style-type: none"> • Hypertension • Coronary artery disease • Cerebrovascular events • Peripheral artery disease • Thromboembolic disease • Arrhythmias • Heart failure
Hormonal men	<ul style="list-style-type: none"> • Reduced steroidogenesis and spermatogenesis → reduced fertility • Gynaecomastia • Testicular atrophy • Testicular cancer • Male-pattern alopecia
Hormonal women	<ul style="list-style-type: none"> • Voice deepening • Decreased breast size • Coarse skin • Excessive body hair growth • Male-pattern alopecia
Infections	<ul style="list-style-type: none"> • Hepatitis B/C • HIV
Hepato-biliary	<ul style="list-style-type: none"> • Peliosis hepatis • Cirrhosis • Tumours • Cholestatic jaundice • Hepatotoxicity • Rare: spontaneous hepatic rupture
Renal	<ul style="list-style-type: none"> • Chronic kidney disease and renal failure
Musculoskeletal	<ul style="list-style-type: none"> • Short stature (if taken by adolescents) • Tendon injuries
Skin	<ul style="list-style-type: none"> • Severe acne and cysts • Abscesses and gangrene at infection site • Oily skin and scalp
Psychiatric & neurological	<ul style="list-style-type: none"> • Aggression, irritability • Mania • Depression +/- suicidality • Delusional disorders • Cerebral atrophy

Table 1. Potential side-effects of longer-term anabolic-androgenic steroid use

stigma, fear of being found out and concerns about taking time off work.

Summary

In primary care, we ought to destigmatise consultations around AAS use in order to help these patients discuss the issues surrounding their drug use. These conversations will allow healthcare professionals to liaise with specialists for safer prescribing (as medications issued by GPs may interact with illicit AAS use and/or associated health problems), educate and/or refer patients to specialist services. One particular issue is how to manage patients who wish to enter medically managed hormone treatment when the hormones taken come from illicit sources that do not contain reliable information on content and strength. Large-scale public health awareness campaigns to highlight the risks of AAS use and signpost to health care services are also warranted.

The bottom line is that there is no easy fix. Future clinical work and research requires a sound collaboration between GPs, psychiatrists, urologists, endocrinologists and sports medicine doctors to tackle the emerging issues surrounding continuing increase of AAS users across the globe.

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