

# Anabolic androgenic steroids: what the psychiatrist needs to know

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**Abstract** Anabolic androgenic steroids (commonly known as anabolic steroids) are synthetic derivatives of the hormone testosterone. They are being increasingly used by professional and recreational athletes to enhance performance, and by men and women to improve physical appearance. This article discusses the characteristics of such steroid ‘misusers’ and the techniques of use. It highlights the psychiatric complications associated with these steroids, including increased risk of aggression, personality disorders, psychosis and mood disorders, particularly manic symptoms. Medical complications of steroid use are common and frequently reversible. Use is associated with an increased risk of injury, cardiovascular events, gastrointestinal complications, virilisation in women, and gynaecomastia and testicular atrophy in men. Whether addiction to these steroids can occur is debatable, but there is evidence for dependence and a withdrawal syndrome. Steroid use may be a ‘gateway’ to other addictions. Users are often reluctant to seek treatment and the psychiatrist’s role in the recognition and management of use is presented.

Anabolic androgenic steroids are synthetic derivatives of the hormone testosterone and they are characterised by a carbon skeleton with a four-ring cyclopentanoperhydrophenanthrene structure. Testosterone is the primary hormone synthesised in the testes in males; in females the circulating levels are typically about 10% of those observed in males. It has both ‘anabolic’ (tissue-building) and ‘androgenic’ (masculinising) properties. During puberty its androgenic action is central to the development of the male phenotype, and the hormone is responsible for the secondary sexual characteristics observed in men. In addition, testosterone regulates muscle protein metabolism, sexual and cognitive functions, erythropoiesis, plasma lipids and bone metabolism (Evans, 2004). The androgenic effect cannot be separated from the anabolic, but purely anabolic steroids have been synthesised in an attempt to minimise the androgenic effects.

Anabolic androgenic steroids (which for conciseness we will call anabolic steroids hereafter) are prescribed for the treatment of male hypogonadism, and there is evidence for their efficacy in the treatment of cachexia associated with HIV, cancer, burns, renal and hepatic failure, and anaemia associated with leukaemia and hepatic failure (Basaria *et al*, 2001). To the general

public anabolic steroids are more commonly known as drugs used by competing athletes as a performance-enhancing (ergogenic) aid. However, the misuse and harmful use of anabolic steroids is no longer the sole domain of elite professional athletes. In recent years the recreational use of these drugs has increased significantly, usually for the cosmetic purpose of enhancing appearance (Johnston *et al*, 2003). Misuse is also no longer limited to a predominately male population, as females are becoming increasingly involved in using anabolic steroids.

Unless otherwise stated, reference in this article to steroid use in general indicates the taking of steroids without prescription. In particular, ‘misuse’ indicates that the drug is being taken in a way that would not comply with medical recommendations and ‘harmful use’ indicates a pattern of use that is causing damage to health but does not meet ICD–10 criteria for dependence (Box 1).

## Anabolic steroids and the law

In the UK, anabolic steroids are prescription-only drugs under the Medicines Act 1968. They can be sold by a pharmacist only on the presentation of a doctor’s

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**Box 1 ICD–10 criteria for dependence**

ICD–10 criteria include experience of at least three of the following during the past year:

- a strong desire to take steroids
- difficulty in controlling use
- withdrawal syndrome when use is reduced
- evidence of tolerance
- neglect of other interests and persistent use despite harmful consequences

(World Health Organization, 1992)

prescription, and a small number of individuals are prescribed them for legitimate medical reasons (see above). Anabolic steroids are also Controlled Drugs, class C (Schedule 4iii), under the Misuse of Drugs Act 1971 (Box 2). It is not an offence to possess anabolic steroids for personal use, but it is an offence to supply them. The penalty for unlawful supply of class C drugs is a maximum of 14 years in prison and an unlimited fine.

In the USA, the Anabolic Steroid Control Act of 2004 was introduced in response to the growing use of steroid precursors (pro-steroids) by professional athletes in particular, thus expanding the list of substances available on prescription only.

## How common is steroid misuse?

There is a dearth of epidemiological data regarding anabolic steroid misuse in the UK. In a survey of 687 students at a British college the overall rate of current or previous use was 2.8% (4.4% in males, 1.0% in females) and, of these, 56% had first used anabolic steroids at the age of 15 or younger (Williamson, 1993).

Over the past decade the harmful use of anabolic steroids has increased both in the UK and in the USA. This was highlighted in a report by the British Medical Association in 2002, which classified steroid misuse as a public health risk. The report (British

**Box 2 Controlled drugs in the UK**

- A drug's class (A–C) determines how dangerous it is perceived to be and the penalties relating to its use. Drugs in class A are considered to be the most dangerous
- A drug's schedule defines who may be in possession of or supply the drug. Drugs in schedule 1 are under the greatest level of control

Medical Association Board of Science and Education, 2002) found that as many as half of the members of dedicated bodybuilding gyms admitted to taking anabolic agents, and that steroid use ran as high as 13% even in some high-street fitness centres. A third of all general practitioners were treating patients who took steroids, and needle-exchange programmes for heroin addicts were reporting increasing numbers of steroid users among their clients.

An annual survey of adolescent drug use in the USA in 2002 found a sharp increase in the lifetime use of anabolic steroids, with lifetime prevalence increased by 1.7% in 10th graders (15–16 years old) and 2.9% in 12th graders (17–18 years old) over a 10-year period (Johnston *et al*, 2003). Recent data from the UK suggest a large rise in anabolic steroid misuse over the past year by a group of people who are distinct from users of other illicit drugs (Druglink News, 2006).

## Who misuses steroids?

There are a number of reasons for the non-prescribed use of anabolic steroids. Athletes use them to enhance performance, driven by the potential financial and other rewards that may come with sporting success. Although older research suggested that anabolic steroids were no more efficacious than placebo in improving performance, such work suffered from a number of methodological limitations that restricted its usefulness. A key factor was that researchers did not use the high 'supraphysiological' doses (see below) necessary to achieve the muscle-building effect (Lukas, 2003). Anabolic steroids allow the user to increase both the frequency and intensity of workouts, in addition to increasing muscle capacity, reducing body fat, increasing strength and endurance, and hastening recovery from injury.

Recreational users of anabolic steroids are the most rapidly expanding group, and their aim is to enhance their physical appearance in order to receive the admiration that Western societies give to a 'perfectly toned' body. A much smaller proportion of those who misuse steroids have experienced physical or sexual abuse, and are trying to increase their muscle size to protect themselves. A further group (possibly between 5 and 10%) includes people who have a form of body dysmorphic disorder (sometimes called 'reverse anorexia nervosa'), in which they believe that they look small and weak, even if they are large and muscular (Brower *et al*, 1991).

## How are anabolic steroids used?

Anabolic steroids can be taken orally, injected intramuscularly and, less commonly, applied topically in

**Table 1 Commonly used androgenic anabolic steroids**

Drug	Effect	Side-effects
<i>Oral preparations</i>		
Methenolone acetate	Limited muscle gain but relatively safe. Relatively little androgenic potency	Causes little water retention or liver damage
Methandrostenolone	Moderate androgenic properties. Also reported to enhance feelings of well-being	Gynaecomastia, fluid retention and hypertension are commonly reported
Oxandrolone	Relatively mild androgenic properties, so popular with women. Has a reputation for increasing strength not size	Gastrointestinal irritation, including pain and diarrhoea, is commonly reported; liver toxicity is possible
Oxymetholone	Widely recognised as one of the strongest oral anabolic steroids available. Highly anabolic and highly androgenic	Headaches and stomach pains reported; very toxic to the liver
Stanozolol	Modest anabolic and weak androgenic effects	Has a reputation for causing gastrointestinal discomfort after prolonged use
<i>Intramuscular preparations</i>		
Boldenone undecenoate	Veterinary product commonly thought to be effective in producing rapid increase in strength and muscle mass	
Methenolone acetate	See above	
Nandrolone decanoate	Most commonly used injectable anabolic steroid for performance enhancement. High anabolic and low androgenic properties	Dose-dependent side-effects may include hypertension, acne and sexual and reproductive problems
Sustanon 250®	Contains a combination of four esters of testosterone. Considerable anabolic and androgenic properties. Fast acting and long lasting	
Testosterone enantate	Moderate androgenic properties; in an injectable oil preparation. Short-lived effects	
Testosterone cypionate	Moderate anabolic and androgenic properties. Oil based, so long acting	Large doses have been associated with aggression; hypertension, premature balding and acne commonly reported

After Lukas (2003) and Lenehan *et al* (2004).

the form of creams and gels (Table 1). Amounts used are supraphysiological, often 10–100 times greater than therapeutic doses. There are three common regimes practised by steroid misusers: ‘cycling’, ‘stacking’ and ‘pyramiding’ (Lukas, 2003).

During ‘cycling’ the user takes the steroid for 4–12 weeks and then stops for a variable period, after which use is resumed again. Users believe that this time-off period helps to minimise side-effects.

‘Stacking’ is the use of more than one steroid at a time, to maximise increases in lean muscle mass, weight gain and strength. The drugs may be administered by different routes, for example as a combination of injectable and oral steroids.

In ‘pyramiding’ the user follows a cycle of building up to a peak dose and then tapering back down

towards the end of the cycle, in the hope of allowing the body’s hormonal system time to recuperate and maintain homeostasis.

Some people use anabolic steroids continuously for years. Various additional drugs are taken to combat the side-effects of the steroids, and these include human chorionic gonadotrophin, diuretics, thyroid hormones, growth hormone and insulin (Table 2).

## Psychiatric complications

Anabolic steroids have been associated with a range of psychiatric symptoms, although the limited research literature in this area does not yet prove a causal link.

**Table 2 Other drugs commonly taken in association with anabolic androgenic steroids**

Drug	Effect	Side-effects/comments
Human growth hormone (HGH)	Widely believed to increase muscle and tendon strength, making rupture less likely	Major side-effects are bone over-growth, cardiomegaly and tendency to develop diabetes
Insulin	Promotes uptake of amino acids by cells and increases protein synthesis. Often used after a workout	High risk of hypoglycaemia
Insulin-like growth factor 1 (IGF-1)	Mediates metabolic effects of HGH. Increases protein synthesis and decreases protein breakdown in muscle	Requires diet high in carbohydrate and containing sufficient protein for cellular reproduction
Clenbuterol	Bronchodilator used to treat asthma. A beta-2 agonist with a potential role as a fat burner	
Human chorionic gonadotrophin (HCG)	Natural protein hormone that mimics luteinising hormone's effects in stimulating production of testosterone. Used to counter negative feedback effects of exogenous steroids	
Tamoxifen	Anti-oestrogenic agent prescribed for treatment of oestrogen-dependent breast tumours. Used to prevent or reduce gynaecomastia	
Diuretics	Used before competitions to remove excess sub-cutaneous water	Can induce electrolyte imbalance
Cytomel®	Synthetic thyroid hormone (T <sub>3</sub> ) used to increase basal metabolic rate by increasing synthesis of protein, carbohydrates and fats	

After Lenehan *et al*, 2004.

### Aggression and violence

Empirical studies in both animals and humans have shown an increase in aggression in both males and females exposed to anabolic steroids (Eisenberg & Galloway, 2005), and self-reported aggression may be the only sign of steroid misuse (Copeland *et al*, 2000). Moderately high doses of testosterone cypionate have been shown to increase aggressive responding in individuals who have not used steroids before (Kouri *et al*, 1995), and increasing doses of methyltestosterone have been correlated with increasing irritability, mood swings, violent feelings and hostility (Su *et al*, 1993). Misusers of anabolic steroids subjectively report significantly more fights, verbal aggression and violence towards their significant others during periods of use compared with periods of non-use (Choi & Pope, 1994). There have been several case reports of what users call 'roid rage', frenzied violent behaviour during the high-dose cycles of steroid use (Lukas, 2003). In 88 athletes who were using anabolic steroids Pope & Katz (1994) found that aggressive or violent behaviour often accompanied steroid-associated manic or hypomanic episodes. Participants admitted to a range of serious episodes, including property damage, assault, being involved in a murder plot and beating a pet dog. Several of the sample had been expelled from home by parents, wives or

girlfriends because of their intolerably aggressive behaviour. Nearly all denied comparable behaviour before steroid use. Other work has suggested that adolescents who abuse anabolic steroids have nearly triple the incidence of violent behaviour (Dukarm *et al*, 1996).

### Psychosis

In earlier research, Pope & Katz (1988) studied 41 individuals who used anabolic steroids. Of these, 5 (12.2%) had psychotic symptoms and 4 (10%) had sub-threshold psychotic symptoms while taking steroids: none had these symptoms when not taking them. A subsequent larger study (Pope & Katz, 1994) found similar results, with psychotic symptoms diagnosed in 3% of the 88 users 'on-cycle', but in none 'off-cycle'. The risk of developing psychotic symptoms may be related to high-dose testosterone (Pope & Katz, 1994; Hall *et al*, 2005).

Clinical presentations include grandiose and paranoid delusional states that often occur in the context of a psychotic or manic episode. Symptoms usually resolve in a few weeks if steroid use is discontinued, although may persist for as long as a month even if adequately treated with antipsychotics (Hall *et al*, 2005).

## Personality disorders

Self-report questionnaires and informant histories have been used to retrospectively assess the personality type of anabolic steroid misusers before their first use. Such work suggests that they start out with personalities similar to those of non-using bodybuilders, but develop abnormal personality traits that could be attributed to steroid misuse (Eisenberg & Galloway, 2005). Cooper *et al* (1996) identified a high rate of abnormal personality traits in a sample of 12 bodybuilders who had used anabolic steroids compared with a matched group who had not. The reported personality traits of the steroid users before the onset of use did not differ from those of the non-users, but in the user group there were significant differences between the before and after traits. During steroid use, individuals were more likely to score higher on paranoia, schizoid, antisocial, borderline, histrionic, narcissistic and passive aggressive personality profiles. Other studies have suggested that antisocial personality disorder is slightly more likely among anabolic steroid users than among non-users (Pope & Katz, 1994). Steroid users have been shown to have a higher prevalence of cluster B (histrionic, narcissistic, antisocial and borderline) personality traits than community controls (Yates *et al*, 1990).

## Mood and anxiety disorders

Affective disorders have long been recognised as a complication of anabolic steroid use. Case reports describe both hypomania and mania, along with irritability, elation, recklessness, racing thoughts and feelings of power and invincibility that did not meet the criteria for mania/hypomania (Eisenberg & Galloway, 2005). Of 53 bodybuilders who used anabolic steroids, 27 (51%) reported unspecified mood disturbance (Lindstrom *et al*, 1990).

The above-mentioned study by Pope & Katz (1988) involving 41 steroid-using bodybuilders used structured interviews to measure affective symptoms according to DSM-III-R criteria. They identified 5 participants (12.2%) who met the criteria for a manic episode during steroid exposure; a further 8 (19.5%) only narrowly missed the diagnosis. Significantly more participants developed a full affective syndrome during periods of steroid exposure (22%) than non-exposure (5%), and 10 were 'stacking' when they experienced manic symptoms.

In a later prospective study, Pope and colleagues (2000) gave placebo or 600 mg testosterone to males aged 20–50 years with no history of steroid use or past psychiatric illness. In the testosterone group, 6% of the men becoming mildly hypomanic and 4% becoming markedly hypomanic.

Su *et al* (1993) administered methyltestosterone (40 or 240 mg/day) or placebo to 20-year-old healthy

men, and one participant developed an acute manic episode.

There is also evidence that depression can be associated with withdrawing from steroids: in Pope & Katz's original (1988) study 12.2% of those using anabolic steroids developed DSM-III-R major depression when they stopped taking the drugs.

## Medical complications

The side-effects of anabolic steroids are well-known (Box 3). Fortunately most of the serious, life-threatening effects appear relatively infrequently, and may be more likely to occur with some of the oral agents. The most common side-effects are less serious, mostly cosmetic and usually reversible with cessation (Brower, 1992). However, observational studies suggest that the majority (88–96%) of anabolic steroid users experience at least one minor objective side-effect, including acne (40–54%), testicular atrophy (40–51%), gynaecomastia (10–34%), cutaneous striae (34%) and injection-site pain (36%) (Evans, 2004).

## Musculoskeletal

It is widely believed that a large increase in muscle mass associated with anabolic steroids can overwhelm the tendons and ligaments and lead to an increase in musculoskeletal injuries among users (Liow & Tavares, 1995). Adolescents who misuse anabolic steroids risk premature closure of epiphyses, leading to a reduction in final height.

## Cardiovascular

There are numerous case reports of unexpected cardiovascular events in anabolic steroid users, and use has been linked to the development of hypertension, left ventricular hypertrophy, impaired diastolic filling and arrhythmia (Kutscher *et al*, 2002). The situation is further complicated by the effect of anabolic steroid use on lipid profile (Box 3), and the use of diuretic drugs in combination with steroids (Table 2). The effects of anabolic steroid use on thrombotic activity is also a risk factor, as platelet aggregation is increased in steroid users (Eisenberg & Galloway, 2005).

## Gastrointestinal

Oral alkylated testosterone can cause primary biliary stenosis and cholestatic jaundice, and this may progress to hepatorenal syndrome. Anabolic steroid use may cause a reversible rise in aminotransferase levels, and may also increase the incidence of hepatic tumours in susceptible individuals (Eisenberg & Galloway, 2005).

**Box 3 Physical signs of anabolic steroid use**

## Musculoskeletal system

- Muscular hypertrophy
- Increases in skeletal muscle enzymes detected by routine serum chemistry

## Cardiovascular system (often reversible after steroid use ceases)

- Decreased high-density lipoprotein cholesterol and increased low-density lipoprotein cholesterol (known risk factor for coronary artery disease)
- Increased blood pressure
- Reported cases of myocardial infarction, left ventricular hypertrophy and stroke

## Hepatic system

- Cholestatic jaundice
- Benign and malignant liver tumours
- Peliosis hepatis (blood-filled cysts)

## Reproductive system

*Males*

- Benign prostatic hypertrophy
- Testicular atrophy
- Sterility
- Gynaecomastia
- Abnormalities of sperm count, motility and morphology
- Painful breast lumps
- Anabolic steroid misuse by prepubertal boys may lead to premature closure of bony epiphyses and a consequent reduction in final height

*Females*

- Breast tissue may shrink
- Menstrual abnormalities
- Masculinisation, including clitoral hypertrophy, hirsutism, deepened voice

## Dermatological system

- Male-pattern baldness
- Acne
- Oily skin
- Jaundice
- Needle marks
- Oedema due to water retention evident in the hands and feet

## Other systems

- Sleep apnoea
- Exacerbation of tic disorders
- Polycythaemia
- Altered immunity
- Glucose intolerance
- Non-hepatic neoplasias

(Brower, 1992)

**Endocrine**

Hyperandrogenism is associated with insulin resistance, although trial results are equivocal and may vary with the type of steroid used. For example, a direct correlation between methyltestosterone administration and insulin resistance has been demonstrated in non-obese women (Diamond, 1998), whereas other work has shown that neither testosterone nor nandrolone adversely affected insulin resistance in men (Hobbs *et al*, 1996).

Aromatisation is the process by which steroid hormones are interconverted. Testosterone and other aromatisable anabolic steroids are metabolised in part to oestradiol and other oestrogen agonists, and males using high doses of anabolic steroids can have the circulating oestrogen levels typical of women during a normal menstrual cycle (Wilson, 1988). This can lead to breast pain in men and gynaecomastia, which is one of the most frequently described side-effects of anabolic steroid use. Gynaecomastia is often irreversible. The effect of anabolic steroids on female breast tissue in the long term is not well studied, although some animal studies suggest that it may cause breast cell autolysis and necrosis (Blanco *et al*, 2002). Anabolic steroids suppress gonadotrophins, with variable effects on sexual interest, erectile function (causing spontaneous erections), the prostate and fertility. Testicular atrophy has been documented in control trials, and oligospermia may follow anabolic steroid use (Eisenberg & Galloway, 2005).

Supraphysiological doses of anabolic steroids in women lead to virilisation. Women taking steroids have reported voice instability (deepening of both projected speaking voice and singing voice), clitoral hypertrophy, shrinking breasts, menstrual irregularities, nausea and hirsutism. Many of these side-effects are largely irreversible. Steroid use can also lead to cutaneous striae, acne and balding. There is a case report of secondary partial empty sella syndrome, with pituitary atrophy from negative feedback associated with the misuse of steroids together with growth and thyroid hormones (Dickerman & Jaikumar, 2001).

**Other complications**

Injecting is the predominant route of administration of anabolic steroids (80% in one study), and so users are at risk of contracting blood-borne viruses including hepatitis B and C and HIV (Brower *et al*, 1991). However, a study of 149 injectors of anabolic steroids in England enrolled between 1991 and 1996 showed that only 2% were hepatitis B core antibody positive, compared with 18% of intravenous heroin users and 12% of amphetamine users. None of the steroid users tested positive for HIV (Crampin *et al*, 1998).

## Dependence

Reports of physical dependence on anabolic steroids first appeared in the 1980s, usually in young male weightlifters, who reported an inability to stop taking them (Brower, 1992). Withdrawal symptoms were prominent in these descriptions, but one case suggested that moderate to severe dependence had resulted from taking anabolic steroids (Brower *et al*, 1989). In a study of 49 male weightlifters (Brower *et al*, 1991), 41 (84%) reported withdrawal effects, with the most frequently described symptom being craving for more steroids. Those who reported being dependent on anabolic steroids generally took higher doses, completed more cycles of use, and reported more aggressive symptoms than those who did not report dependence.

Symptoms of steroid withdrawal include mood disorders (with suicidal depression as the most life-threatening complication), apathy, feelings of anxiety, difficulty in concentrating, insomnia, anorexia, decreased libido, fatigue, headache, and muscle and joint pain (Corrigan, 1996). It is often difficult to distinguish symptoms that are due to neuronal rebound in withdrawal from those that can be said to be psychological in origin. Observing oneself to lose muscle mass, strength, performance and confidence after cessation of steroid use has a powerful negative effect on mood, and this may lead to a strong desire to take steroids again.

Survey data have provided some evidence of the development of a full dependence syndrome in anabolic steroid users. In the above-mentioned study by Brower *et al* (1991), 28 (57%) met DSM-III-R criteria for dependence, based on responses to an anonymous self-administered questionnaire. Examination of the symptoms reported revealed features of both physical and psychological dependence, with some users reporting up to six of the DSM-III-R features of substance dependence.

### Mechanisms of dependence

Various mechanisms have been suggested to explain the development of a dependence syndrome, including the effect of anabolic steroids on endogenous opioids or monoamine systems in the brain, and dependence resulting from social reinforcement of a muscular physical appearance. When enquiring about dependence, the psychiatrist must distinguish between the effects of steroid use and those of weight training, which may act as a confounding factor. For example, weight training, even in the absence of steroid use, may have a noticeable impact on lifestyle, as it can involve spending a lot of time in the gym and on a strict diet. However, only time actually spent on obtaining, using and recovering from the

effects of the steroids meets the diagnostic criterion for dependence of spending large amounts of time on drug-related activities (Brower, 2002).

### Links to other substance misuse

It has been suggested that anabolic steroid use may serve as a gateway to opioid misuse. In a study of lifetime drug use by 223 men admitted to a substance misuse treatment unit primarily for treatment of alcohol, cocaine and opioid dependence, 29 (13%) reported prior anabolic steroid use. Eighteen of these men reported that anabolic steroids were the first drugs that they had ever self-administered by injection, and seven men with opioid dependence reported that they first learned about opioids from friends at the gym, and subsequently first obtained opioids from the same person who had sold them anabolic steroids (Kanayama *et al*, 2003).

## Evaluation and treatment

It is rare for users of anabolic steroids to present to medical services with a primary complaint of steroid use. Most do not view themselves as drug misusers, as steroid use is seen as a positive step towards bettering themselves physically. Furthermore, users have little trust in doctors' knowledge of anabolic steroids, and often do not disclose their steroid use in consultations. In one study, 40% of users trusted information on anabolic steroids from their drug dealers at least as much as information from any physician, and 56% had never revealed their steroid use to a doctor (Pope *et al*, 2004). It is therefore important to consider the possibility of steroid use, particularly in high-risk groups such as men who engage in weight training or sports that require strength or power. Enquiries should be made about the perceived benefits of anabolic steroids and the side-effects experienced (both physical and psychological). Denial of steroid use obviously does not rule out harmful use of these drugs. In an anonymous confidential questionnaire survey of 1004 male bodybuilders in London, more than 10% reported ever injecting anabolic steroids. However, only 36% of these individuals said that they admitted this to a physician. This highlights the need to promote open communication with patients who may be reluctant to disclose potentially risky, illegal or embarrassing behaviours (Bolding *et al*, 1999).

### Physical examination

The combination of muscular hypertrophy with testicular atrophy in males or virilisation in females is strongly suggestive of anabolic steroid use. However, there is a wide normal variation in the habitus of the

population and the clinician must be aware of this in order to avoid an incorrect diagnosis of steroid use. For example, a normal teenage pubertal male may exhibit breast buds, small testes and cystic acne. Similarly, endocrine disorders may mimic harmful use of anabolic steroids: polycystic ovary disease and idiopathic hirsutism are highly relevant and treatable examples of this. Muscular hypertrophy and thin abdominal skin folds are among the most common findings in anabolic steroid users. Unusual injuries such as ruptured tendons, ligaments or muscles should also alert the clinician to possible steroid use (Eisenberg & Galloway, 2005). Unexplained or pronounced aggression may be the only obvious symptom or sign (Copeland *et al*, 2000). The use of other illicit drugs should always be considered.

### Laboratory tests

Urine testing can confirm anabolic steroid use and be used as a measure of abstinence. Although these tests are common in competitive sports, they are not usually available from hospital laboratories as part of routine drug screenings in the clinical setting. In addition, their use as a screening method for evidence of drug cessation is complicated by the fact that many injectable steroids have long half-lives and are lipophilic, resulting in sequestration in adipose tissue and potential detection in urine a number of months after use. Alterations in liver transaminase levels, or an unusual low-/high-density lipoprotein cholesterol profile may also suggest anabolic steroid use.

### Treatment

Very few anabolic steroid users enter treatment for dependence, and research evidence is limited. Treatment recommendations can be made on the basis of the treatment of other substance misuse disorders, along the lines of abstinence, treatment of withdrawal symptoms and maintenance (Eisenberg & Galloway, 2005). One important difference with steroid users is their emphasis on physical attributes, compared with other drug users who often begin to disregard their appearance as drug use becomes paramount. Thus, psychological interventions should encompass the physical aspect and help users to accept the loss of both idealised and realised physical attributes.

The role of pharmacotherapy is poorly defined. Medication for psychiatric symptoms should be based on a consideration of the risks and benefits, including its potential side-effects. Depressive symptoms are common during steroid withdrawal, and the use of antidepressants is indicated when symptoms persist and meet criteria for major depression. Selective serotonin reuptake inhibitors (SSRIs) such as fluoxetine have shown some promise in cases series (Malone & Dimeff, 1992). The SSRIs also have

low potential for overdose, adverse cardiac effects and anticholinergic side-effects, all of which must be taken into account when treating people who have an increased risk for suicide, cardiotoxicity and prostatic hypertrophy. Antipsychotic drugs may be needed to treat persistent and marked irritability, aggressiveness or agitation.

## Conclusions

Anabolic steroid use has increased in prevalence in many high-income countries over the past decade, and it can lead to aggression, depression, mania and psychosis, in addition to a range of physical complications. Psychiatrists should be aware of the possibility of steroid use, particularly in young men. Knowledge of the potential physical signs, combined with a detailed assessment of all drug use, will enable the clinician to include anabolic steroid use in a differential diagnosis where relevant. Abstinence from steroid use usually leads to a reversal of most physical and psychological signs, although a withdrawal syndrome has been described. The symptoms of dependence on anabolic steroids are similar to those seen with other drugs of misuse, suggesting that some of the conventional drug misuse treatments may be effective with people dependent on steroids.

## Declaration of interest

None.

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## MCQs

- Anabolic androgenic steroid use is associated with:**
  - decreased risk of violent behaviour
  - reduced frequency of manic or hypomanic symptoms
  - increased risk of psychosis on- and off-cycle
  - lower prevalence of cluster B personality traits
  - gynaecomastia in men.
- Which of the following statements is not correct?**
  - anabolic steroids increase platelet aggregation
  - anabolic steroid use may lead to hepatorenal syndrome
  - all types of anabolic steroids increase insulin resistance
  - anabolic steroid use can lead to a reduction in final height if used by adolescents
  - anabolic steroids vary in anabolic potency.
- Regarding the treatment of anabolic steroid users:**
  - abstinence cannot be objectively monitored
  - antipsychotics have no role in treatment
  - psychological interventions need to focus purely on drug use
  - SSRIs should not be used
  - an assessment of beliefs about physique and appearance is important.
- Anabolic steroids:**
  - have only anabolic effects
  - are injected intravenously
  - are illegal to possess
  - cause body dysmorphic disorder
  - are proven to increase muscle mass.
- Anabolic steroid users:**
  - are at high risk of sharing needles
  - are always competitive athletes
  - can use needle exchanges as frequently as opiate users
  - can always be said to be dependent
  - avoid practising polypharmacy.

### MCQ answers

1	2	3	4	5
a F	a F	a F	a F	a F
b F	b F	b F	b F	b F
c F	c T	c F	c F	c T
d F	d F	d F	d F	d F
e T	e F	e T	e T	e F