Review

Anabolic steroids and the mind

Brian Corrigan

Anabolic steroids were first used by weight lifters and others involved in pursuits of strength, but are now taken, often in large doses, by young men interested in enhancing their appearance. The severe psychogenic side effects of these high doses include aggressive and violent behaviour. Problems with drug withdrawal and drug dependence are also common in users of anabolic steroids and these drugs may also provoke psychiatric disorders. I review these complications, as reported in the past decade, and comment on two recent violent murders in Sydney in which anabolic steroid use was implicated. **(MJA 1996; 165: 222-226)**

Sydney has recently witnessed two particularly brutal murders by users of anabolic steroids. One man with recent paranoid tendencies took a claw hammer and battered his wife to death, and then shot himself. In the second murder a man met a woman he knew at a nightclub and they went to the stairwell of a nearby hotel. In the man's words "something snapped" and he murdered the woman. Experienced police described it as the most brutal attack they had encountered. In both these murders the level of aggression and violence fits the descriptive term steroid rage ("roid rage").

The male hormone testosterone, derived mainly from the testes, is an anabolic and androgenic steroid responsible for the production and maintenance of the male physical features,[1] as well as the recognisable male psychological and behavioural attributes.[1-3] Numerous human and animal studies support the psychological and aggressive effects of testosterone use, and some reports correlate testosterone levels with aggressive behaviour and dominance.[2,3]

Anabolic steroids are derived by chemical manipulation of the 19-carbon testosterone molecule. Despite well documented problems with their use, they are widely abused in the community for non-medical reasons, mostly by young men to enhance their appearance by "bulking up" (i.e., increasing their lean muscle mass without increasing fat). How common their use is in Australia is not known, but a recent survey in the United States concluded that there were at least three million users at any one time and at least one million former users.[4]

Side effects can occur with all anabolic steroids.[5] The higher the dose the higher the risk is the general rule, and side effects can be sudden, severe and unpredictable, and include sudden death.[5]

The most common group of side effects involve psychological and/or psychiatric changes. Being psychoactive substances,[3,6] anabolic steroids are expected to produce some degree of psychological change after they have been taken for some time. Indeed, these changes (which include an increase in self-confidence, energy and motivation), if they allow people to train harder, may well be one of the main factors explaining the mechanism of action of anabolic steroids.[7]

Psychological effects

One of the earliest papers on psychological effects reported the side effects of anabolic steroids in 32 weight-trained men;[8] 56% had a subjective perception of increased irritability and aggression. This also applied to a smaller group of 10 weight-trained female athletes.[9] A more recent report compared 13 anabolic steroid users with 14 non-users and 18 former users.[10] Steroid users had more frequent episodes of anger, which were of greater intensity and duration, and a more hostile attitude towards others. In general, psychological changes need to be related to the dose and duration of anabolic steroid use (e.g., taking one or two 5 mg tablets would not produce any changes, but after taking an increasing dose for some days several psychological changes may occur). These changes will develop if anabolic steroids are taken for long enough (just how long could possibly depend upon individual tolerance).

The psychological changes that occur can be arbitrarily divided into three groups, representing a continuum of effects from milder through to more severe changes, especially if continued high doses are taken.

- Early effects are seen as changes in mood and euphoria: there is an increase in confidence, energy and self-esteem, with enhanced motivation and enthusiasm. There is also diminished fatigue, sleeplessness and an ability to train through pain. Libido may be decreased, but is more often increased, sometimes markedly.[11] Irritability, anger, agitation and a "strange edgy feeling" are commonly reported.
- With larger doses or after taking anabolic steroids for a longer time, there is a loss of inhibition and a lack of judgement, with mood swings or grandiose ideas. Prolonged users become suspicious, quarrelsome, impulsive and more aggressive.[7]
- Severe effects manifest when these aggressive feelings increase to the extent that violent, hostile, antisocial behaviour develops, meriting the descriptive title, well known in the steroid-taking community, of "roid rages". These rages can result in property damage, self-injury (including reckless driving or crashing cars), assaults, marriage break-ups,

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Murders associated with anabolic steroid use in Sydney

Case 1

A 29-year-old male body builder bashed his wife to death by repeatedly hitting her with a claw hammer while his four children were in the house. He then shot himself through the head. His home life had apparently been happy up to this time and he was not known to be aggressive.

He had been an anabolic steroid abuser for some years on and off, and in the seven weeks before the murder had self-injected 13.75 mL of stanozolol and at least 1 mL of testosterone (Sustanon, Organon).

Urine tests showed a strongly positive result for stanozolol (1360 ng/mL) and a testosterone : epitestosterone ratio of 17 (normal ratio, one; six is considered the upper level allowable for sports drug testing). This high level indicated testosterone abuse also. His urine also showed evidence of diazepam, but was otherwise normal.

There is little doubt that this behaviour fits the features of a steroid rage.

Case 2

A 22-year-old body builder murdered a woman by first repeatedly bashing her head against a wall and then kicking her. He showed no evident remorse and drove home to bed.

He had previously taken an eight-week course of 50 mg nandrolone (Deca-durabolin, Organon) per week given to him by a friend and felt "heaps more energy, crankier, more aggression, increased libido and more uptight". He stopped taking the drug for about two months, and then took nandrolone for three weeks before the murder — about 1.7 mL per week of a veterinary preparation (50 mg/mL) by intramuscular injection. He came from an apparently caring family, had not previously used any drugs, and had never been known to be violent. His urine was positive for nandrolone but was otherwise normal. He had drunk about three litres of beer in the three hours before the murder.

This behaviour also suggests a steroid rage with its severe degree of violence and indifference. However, if this is so, it would be the smallest dose yet recorded for a steroid rage.

domestic violence,[12] child abuse,[12] suicide[13] and attempted murder or murder.[14-20]

Partners of anabolic steroid users are at particular risk of serious injury, and there is even a self-help group, Anabolic Steroid Wives Association,[21] to help provide them with support. One group of men who often take anabolic steroids in high doses are those working as security officers or nightclub bouncers;[22] under the influence of the drug they may be provoked into a rage and seriously injure people, and at least one person has been killed as a result.[22]

How common these rages are is not known. There is often a great reluctance by anabolic steroid users to report them to doctors, but they may be reported at times by the family. Rages generally result from taking a high dose for a prolonged period; how high a dose and for how long are yet to be defined. In addition, not all people taking high doses develop steroid rages. On the other hand, there are a few reports of rages in those taking quite low doses.[17,23-25]

Some common features have been noted in men having these rages. They are generally young, come from apparently caring families, have not previously taken drugs or been in trouble with the police, and do not have a history of being aggressive. They usually feel no remorse at all after the rage, however antisocial their behaviour.[21] It has been suggested that there may be an underlying predisposition to this type of behaviour and that excessive drug use "pushes them over the edge"; however, nearly all the cases described in the literature fit the description above.

The first two murder cases in which taking anabolic steroids was used as a defence (called the "dumbbell defence" by *Newsweek*) were in the United States in 1988; both men were found guilty of murder. Some 20 murders associated with the use of anabolic steroids have been reported in America,[26] but the usual pleas of innocence due to temporary insanity have never been upheld there. Sydney's two cases are summarised in the Box.

Withdrawal symptoms

All types of steroid drugs, including corticosteroids, produce withdrawal symptoms.[2] Depression is almost invariably one of the symptoms in anabolic steroid users: they miss the feeling of elation induced by the drugs. Other symptoms relate to loss of the positive psychological effects and include listlessness; apathy; loss of appetite, libido and self-esteem; feelings of anxiety; difficulty in concentrating; and mood swings.

Withdrawal can also be associated with violent behaviour and rages. Hence, rages may result from taking either a high steroid dose or stopping taking the drug. Severe symptoms of steroid withdrawal may not be a problem in athletes, possibly because they take anabolic steroids in certain well defined phases and because they reduce the dose gradually. Body builders or weight trainers, however, have greater problems with withdrawal. They lose their new improved body image as their recently enhanced musculature shrinks away, and are likely to be driven back to taking steroids again and to have great trouble stopping them in the future.[27]

Drug dependence

Another related problem is drug dependence; pharmacological, psychological and genetic factors may all have an effect. This problem was first described in 1988 in a 23-year-old body builder;[28] anabolic steroid dependence was later reviewed,[29] and two other case reports followed.[30,31] Brower et al. produced a series of papers on anabolic steroid dependency and its management.[32-37] They initially published a case in a 24-year-old weight trainer with drug dependence, depression and aggression,[32] and later reported eight steroid-using weight lifters (age range, 23–65 years) who showed evidence of dependence at interview according to criteria of the *Diagnostic and statistical manual of mental disorders* (DSM-III-R).[33] In a review of 49 male weight lifters, average age 24 years, 28 (57%) were considered to be drug

Criteria for anabolic steroid dependence

- More anabolic steroid taken than intended.
- A desire to cut down or to control the anabolic steroid dose, yet unable to.
- A large amount of time spent on drug-related activity.
- Frequent intoxication or withdrawal symptoms when expected to function or in physically hazardous situations.
- Social, leisure or work activities are replaced by anabolic steroid use.
- Anabolic steroid use continued despite problems caused or worsened by its use.
- Tolerance built up and supratherapeutic doses are required.
- Withdrawal symptoms such as depression, fatigue, headaches and psychomotor retardation develop.
- Anabolic steroids are used to relieve or avoid withdrawal symptoms.

Many of these criteria apply to most heavy anabolic steroid users.

dependent.[37] Mechanisms discussed were either that (i) anabolic steroids may affect endogenous opioid[28] or monoaminergic brain systems, or (ii) that dependence may result from social reinforcement and the pleasure of having a muscular body. However, users were more likely to have expressed dissatisfaction with their body size and so dependence was considered to be driven more by negative reinforcement (trying to avoid feeling small). The presence of more than three DSM-III-R criteria is considered consistent with drug dependence, and Brower et al. found anabolic steroid users may have up to six of these (Box 2).[37]

Other psychiatric changes

eral psychiatric disorders have been reported in association with anabolic steroid use since the first case was described in 1980.[38,39] The full list includes schizophrenia,[38] hypomania and mania,[40] delirium,[41] depression,[42] suicide,[10,28,43] and paranoia.[44]

In the first reported case of anabolic steroid-related psychiatric disorder, in 1980, a 17-year-old male body builder developed acute schizophrenia when taking methandienone; he recovered on stopping the drug, but relapsed when he took it again.[38] In 1992, Freinhar and Alvarez[40] noted that referring doctors "often" commented on mood changes accompanying anabolic steroid therapy, and described a 27-year-old body builder with hypomania who was taking oxandrolone. He recovered on withdrawal of the drug but had a second attack when taking oxymetholone. A toxic confusional state with choreiform movements occurred in another patient taking 200–300 mg a day of oxymetholone; the condition improved on drug withdrawal.[41]

Perry et al. studied 20 weight lifters taking anabolic steroids and 20 controls using a self-administered questionnaire and an interview.[45] The questionnaire showed an increase in psychotic features in the users, including paranoid thoughts, depression, increased hostility and aggression.

Pope and Katz in 1987 reported two cases of psychosis in anabolic steroid users,[46] and then, in 1988, 41 cases (39 men) with a wide range of psychiatric problems.[47] This study was widely criticised because it was not a controlled, prospective trial and because of its selection of subjects. In 1994, they rectified this with a controlled study of 88 athletes who used anabolic steroids and 68 controls.[48] The Structured Clinical Interview for DSM-III-R was used for diagnosis; 25% showed evidence of drug dependence and 23% hypomania, mania or depression. Aggression or violence "often" accompanied hypomanic or manic episodes. The authors also suggested that steroid users are most vulnerable to major depressive episodes during the first three months after discontinuing anabolic steroid use.

Depression has been mentioned previously in relation to drug withdrawal and dependence. Testosterone was formerly used to treat depression, but it is now known to cause it.[49] Suicide may also be a problem with either anabolic steroid drug dependence or after drug withdrawal (especially with sudden withdrawal). It is not often reported in medical journals, but may be reported in the press. Brower et al. reported a body builder who had suicidal thoughts of crashing his car, and warned of the dangers of anabolic steroids and suicide.[32]

A different view of anabolic steroid complications was taken by Dimeft and Malone:[50] in 31 current users, 45 previous users and 88 non-users, they found psychiatric diagnoses to be more common in previous users, suggesting that psychiatric disorder may either predispose a person to, or result from, anabolic steroid use.

There is one study which gives a contrary view. Bahrke et al.,[51] using two valid psychometric inventories, studied 50 men (12 current steroid users, 14 previous users, and 24 non-users) and concluded that users taking an average daily dose of 45 mg showed minimal psychiatric effects.

In conclusion, this brief review highlights some of the psychological problems encountered with anabolic steroid use. It does not appear that these problems are very common, but future research will show how much disability they cause.

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