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CASE REPORT

Postoperative course and anabolic-androgenic steroid abuse – a case report

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Summary

It is estimated that 80% of weight lifters and body-builders take anabolic-androgenic steroids. Their long-term use is associated with a variety of pathological conditions and premature death. Anabolic-androgenic steroid abuse may lead to changes in the presentation and progression of some conditions. It remains unclear whether anabolic steroids should be given to patients with a history of abuse of these drugs who are to undergo surgery. We report on a fatal outcome following surgery in a 48-year-old weight lifter.

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Case report

A 48-year-old weight lifter was admitted for surgical treatment of aortic stenosis. He had no previous history of rheumatic fever. He had been working for > 20 years as a miner. For the previous 6 years he had been practising power-lifting, achieving high sport scores and performing at national level. For many years he had been using anabolic-androgenic steroids (AAS), more intensively in the previous 7 years. He used several AAS concurrently, usually in 3–4-month cycles, on average for 9 months of each year. During a cycle he would typically take 600 tablets of metandienone 5 mg (Metanabol®, Jelfa, Jelenia Gora, PL), 90–120 ampoules of testosterone 50 mg (Testosterone propionicum or prolongatum, Jelfa, Jelenia Gora, PL), 60 ampoules of nandrolone 50 mg (Deca Durabolin®, Organon, Oss, NL) and 60 ampoules of parabolon (Parabolon-S®, Pharm-Tec®).

He complained of palpitations, nocturnal precordial pain which was unrelated to effort, nocturnal dyspnoea and a tendency towards episodes of fainting without loss of consciousness. These symptoms had been present for 2 years, but had recently become more frequent and more intense.

On admission, physical examination revealed a large-framed man (171 cm/120 kg) with an athletic body habitus. The heart rate was 80 beats.min^{-1} and regular, and the blood pressure was 110/80 mmHg. On auscultation there was a grade III ejection systolic murmur in the aortic area, radiating into the carotid arteries. The haemoglobin was 18.8 g.dl with a haematocrit of 57.9%. Basic biochemical tests including urea and electrolytes and liver function tests were within normal limits. Endocrine tests including TSH, triiodothyronine (FT3), thyroxine (FT4), prolactin and cortisol secretion profile were also within normal limits. Luteiuising hormone was < 0.1 mU.ml^{-1} (1.4–7.7), Follicle stimulating hormone < 0.1 mU.ml^{-1} (1.5–14.0) and testosterone 1.84 ng·ml^{-1} (3.6–11), and these values meet the criteria for hypogonadotropic hypogonadism.

Chest X-ray showed an enlarged heart. ECG showed left bundle branch block. Echocardiography demonstrated aortic valve disease with critical narrowing (gradient > 80 mmHg), left ventricular hypertrophy (septum > 15 mm, posterior wall 12 mm) and diastolic diameter at the upper limit (56 mm). A 24-h ambulatory taped ECG was recorded and 102 299 complexes were analysed. Mean heart rate was 71, maximum 119 (at 08.16 h), minimum 44 (at 01.05 h) beats.min^{-1}. There

were nine single ventricular beats and one episode of ventricular tachycardia (rate 198 beats.min^{-1}, lasting 6.4 s). Supraventricular arrhythmia consisted of 1182 single beats, without pauses or dropped beats, with one period of bradycardia and no supraventricular tachycardia. During the whole analysis there was a sinus rhythm, interrupted with numerous supraventricular premature beats and single ventricular extrasystole deriving from three ectopic foci, and one episode of ventricular tachycardia described above. Coronary angiography revealed no narrowing in any of the coronary arteries.

The patient was assigned to undergo aortic valve replacement. During the operation the stenotic and calcified aortal valve was removed and a prosthesis (Medtronic Hall 25 A) implanted. After one defibrillation, recovery of efficient sinus rhythm was obtained and extracorporal circulation discontinued with a blood pressure of 120/70 mmHg and heart rate 100 beats.min^{-1}. No inotropic support was required.

The postoperative course was complicated with bleeding from the aorta and, a few hours after the procedure, re-thoracotomy was performed. Immediately after the reoperation the patient's circulation was stable, but atrial fibrillation then developed, leading to circulatory insufficiency, which was treated with norepinephrine, dopamine and amiodarone.

After a period of circulatory stability in ICU, the patient was extubated on the second postoperative day, but reintubation was required and the patient required mechanical ventilation for 21 days. Difficulties resulted not only from the upper respiratory tract infection, but principally from muscular weakness, which improved after treatment with three ampoules of intramuscular testosterone (Omnandren 250®, Jelfa). This finally enabled discontinuation of mechanical ventilation. The patient then received hydrocortisone and testosterone. On reaching optimal condition he was transferred to a local hospital, where apart from steroids he received routine cardiological treatment (amiodarone, acenocoumarol, verapamil). In spite of this management, on the 39th day after the operation, the patient died in hospital. Symptoms before death included dyspnoea with facial and neck cyanosis, firstly with sinus tachycardia, then with atrial fibrillation and decrease in blood pressure to undetectable values, and then cardiac arrest. During the whole resuscitation, lack of respiratory function was observed. The patient died of respiratory failure.

Discussion

Although it is difficult to obtain an accurate assessment of the prevalence of AAS abuse, it appears to be widespread, particularly in certain groups such as weightlifters [1]. The problem is especially found in those who are at the peak of their sporting careers or are about to finish, as was the case with our patient. Parssinen *et al.* [2] has shown that mortality in the powerlifter group is about four times higher than in the normal population.

Typical side-effects of AAS were seen in our patient: increased liver enzyme activity, reduction in HDL and elevation of circulating LDL, increased haemoglobin, haematocrit and erythrocyte levels.

Cardiovascular complications including myocardiopathy also have been noted in those who were taking high ASS doses [3]. In our patient echocardiography confirmed an aortic defect with critical narrowing, left ventricular hypertrophy and diastolic dimensions at the upper limit.

The response of the cardiac myocytes and capillaries to the combined influence of various AAS and muscular exercise is not fully known. Testosterone derivatives may inhibit the exercise-induced augmented vascularisation, while (under training conditions) it leads to myocyte hypertrophy. Anabolic-androgenic steroids can modulate transcription, translation and enzyme function, thus influencing alterations in cellular pathology and organ physiology. They also induce (or enhance) changes in extracellular space of myocardium and both endo- and epicardium (increased collagen deposition, redistribution of collagen synthesis, cell separation). AAS has also direct cardiac cell toxicity. Such cell injury with tissue necrosis results in fibrotic areas that can predispose to potentially fatal ventricular arrhythmia [4]. Thus, we could conclude that the severe supraventricular cardiac arrhythmia in our patient resulted not only from valvular heart disease, but also from fibrotic changes of the myocardium.

The case described above is very interesting not only as an example of uncontrolled AAS abuse by the athlete at the decline of his career, but above all as a problem of anabolic administration in patients with long-term history of AAS abuse who are to undergo surgical treatment.

In this case the patient stopped taking AAS 3 months before intervention without any withdrawal symptoms (e.g. depressed mood, fatigue, muscle and joint pain, restlessness, anorexia or insomnia). Investigation performed showed normal adrenal gland function and maintained features of hypogonadotropic hypogonadism. There were no somatic features of hypoandrogenism. The decision not to administer testosterone substitution was made in order to avoid the risk of complications such as an increase in arterial pressure, electrolyte disorders or coagulation abnormalities which could lead to increased thrombosis.

The postoperative course was disturbed because the patient was unable to breathe spontaneously. The prob-

lem lasted for 21 days and regressed immediately (together with muscular weakness) after intramuscular administration of testosterone esters.

We have considered the role of testosterone in this regard. Testosterone is known to be a potent neuroendocrine hormone, with multiple effects on the central nervous system, including the behaviour and control of gonadotropin secretion. It also has an influence on ventilation, chemosensitivity and respiratory rhythm. A study by White *et al.* [5] indicated that ventilation increased after testosterone administration and this increase was associated with comparable increases in metabolic rate. Hypoxic sensitivity was also increased with androgen replacement. Possible explanations for these findings are that testosterone might affect the carotid body and the nervous system or they could be related to the effect of testosterone on muscle. If respiratory muscle strength increases with testosterone administration, then chemosensitivity and ventilation may increase. Alternatively, there are case reports that have suggested that testosterone may have adverse effects on breathing during sleep. In many studies it has been observed that administration of testosterone in physiological doses to hypogonadal men produces an increase in disordered breathing and sleep apnoea in some individuals [6, 7]. Interruption of treatment with testosterone resulted in clinical improvement in these men. If hypoxic drive is augmented by testosterone, the associated hypoventilation and apnoea seen during testosterone administration might be analogous to those seen at high altitude, where it appears that increased ventilatory chemosensitivity may act to drive carbon dioxide tensions below levels required to sustain regular breathing. The above would advocate the use of testosterone for its effect on the control of respiration. Another possible explanation is its influence on muscle strength.

It is evident that motionless skeletal muscles tend to undergo atrophy. An analogous situation concerns respiratory muscles and the diaphragm in patients who remain on controlled respiration for a long time. It is possible that muscular atrophy progresses more rapidly when muscles are stimulated earlier with large doses of anabolic steroids.

In Ferguson's [8] study of cortisone and testosterone effects on diaphragmatic function and biochemistry in the rabbit, testosterone had no significant impact on diaphragmatic strength, endurance or biochemistry. However, concomitant administration of testosterone with cortisone blunted the effect of cortisone on respiratory muscle function. What is more, in healthy subjects with tetraplegia, the use of oxandrolone was associated with significant improvements in weight and pulmonary function, and a subjective reduction in breathlessness. Therefore, oxandrolone may be indicated to strengthen respiratory musculature in individuals who have for example tetraplegia and ventilatory insufficiency aggravated by superimposition of, e.g. pneumonia [9]. Given that AAS use leads to muscle hypertrophy (and increase in strength) not only in conjunction with strength training, but also in still muscles [10], an improvement in respiratory muscle function in our patient after testosterone administration seems to be obvious.

Anabolic-androgenic steroids withdrawal is an important, though rare, medical problem because of the potential for this to cause physical and psychological dependence. Thus discontinuation of high-dose, long-term anabolic steroid use, apart from endocrine dysfunction, may lead to development of withdrawal symptoms, which usually requires treatment. The case described above focuses attention on the possibility of unexpected complications that may occur in patients who stop taking AAS after long-term use and then undergo a particularly stressful procedure, such as extensive surgery. The optimal treatment strategy for patients in this situation remains unclear.

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