Licit steroid use – hope for the future

Anthony P. Millar MB, FRACP, FACRM

Lewisham Sports Medicine Clinic, Petersham, Sydney, Australia

Anabolic steroid use has escalated in recent years along with law enforcement. A total of 169 athletes participated in a trial of medical prescription designed to minimize harm as drug elimination is impossible. This showed one-third of athletes achieved their goal in one course, and few were frequent users over the 3-to-5-year period of the trial. Side effects were minimal and reversible.

Keywords: Anabolic steroids, side effects, medical prescription, law enforcement

The use of extraneous substances to improve performance dates back to the beginning of the human race when Eve offered Adam an apple to enhance his characteristics¹. They have been used by Australian Aborigines, Greeks and the Andean Indians among others from time immemorial for performance improvement². The practice has been with us from antiquity and is never likely to disappear.

The development of anabolic steroids and their use in enhancing sporting performance has led to an explosion of drug taking, initially in high level sports but now use of anabolic steroids pervades the whole sporting community³⁻⁵. They are *the* drug for power sports and body building and are used by those who simply wish to add to their own bodily attributes for personal satisfaction. There has been a widespread condemnation of their use and calls for their banning. They have been outlawed as being unfair and dangerous but the inconsistency in this view was pointed out by Fost⁶ who showed that the community already accepts unfairness and danger in sports without complaint.

Law enforcement has failed to stop the flow of drugs. Indeed, one must raise the question – is it worth the cost? There is a moral decision to be made – should scarce resources be spent on preventing drug usage in sports people who only injure themselves when crime by one person against an innocent victim is so rampant? There has been a great deal of publicity on this subject much of which has called into question the trustworthiness of athletes and their coaches. However, Olympic officials have been shown to be dishonest^{7,8}. Community attitudes

towards drugs in sport are changing. The war against drugs is not being won. The battle plan is obscure – are we to eliminate the drug, the taking of the drug or the factors in the community that lead to drug taking⁹?

Educational programmes by the medical profession have stressed the negative values of the drugs and are not heard by drug users. They are fully aware of the positive effects as quoted in their bibles. The *Underground Steroid Handbook*¹⁰ detailed the straight facts on steroid use but all of these facts are displayed in an emotional manner designed to stimulate the reader to use more of the drug than is necessary. Perry¹¹ stated that 'it will only be when Sports Medicine Specialists become experts in steroid pharmacology and toxicology that athletes will be likely to turn away from underground sources towards medical counselling'. As the problem is increasing and expanding throughout the world new measures are called for to try at least to curb the individual's use of the materials.

Subjects and methods

With a view to harm reduction, a study was undertaken to assess the feasibility and results of a steroid prescription programme under medical control. Participants in the study were monitored from January 1987 until the end of December 1991. Male athletes who were referred by their medical practitioner in the years of 1987, 1988 and 1989 for advice on their training programme and anabolic use were the participants. The areas discussed were the developmental aspects of weight-training programmes, dietary control and the use of anabolic steroids. This represents a fall-back position from total abstinence in order to diminish rather than eliminate drug usage and its side-effects. All new patients seen during that period, who denied previous anabolic use, were admitted to the study. On their initial visit, a medical history was taken with emphasis on their training programme, dietary habits and sleep patterns. A medical examination was carried out. All had height and weight recorded. Body composition was determined by electrical impedance using a BIA 103 Analyser (RJL Systems, Detroit, Michigan, USA).

Blood was drawn for estimation of liver enzymes: aspartate aminotransferase (AST); alanine aminotransferase (ALT); lactate dehydrogenase (LDH); alkaline phosphatase (AlkP); cholesterol; triglycer-

Address for correspondence: Dr A. P. Millar, Director of Research, Lewisham Sports Medicine Clinic, 1-7 West Street, Petersham, New South Wales 2049, Sydney, Australia

© 1994 Butterworth-Heinemann Ltd
0306-3674/94/020079-05

ides; bilirubin; and high density lipoprotein cholesterol (HDL). These estimations were performed on DT60 and DTSC units (Eastman Kodak, Rochester, New York, USA) using the dry chemistry techniques for which the units were designed. The laboratory participated in a quality control programme run by the Royal Australian College of Pathologists and control specimens were run with each test batch. All specimens were analysed within 1 h of being taken.

Athletes under the age of 19 years were strongly advised not to use steroids and to return at 3-monthly intervals to assess their growth pattern and to determine when height growth stops. Athletes who were not training at least 4 days a week with a programme in which heavy work loads were being undertaken were advised to reconsider their programme. They were instructed to train in a progressive programme using initially sets with 12 to 15 repetitions to failure and then increase the resistance and decrease the repetitions always ensuring that failure was reached. The load was stepped up until only two to three repetitions were possible. This principle was applied to all body parts exercised at each session. Over the 4 days each part was stressed at least twice. They were instructed to return when the programme modifications had been implemented and weight and strength gains had risen to a plateau. Dietary advice was given particularly to improve the balance of protein in the diet, generally being taken at 3–4 g kg body weight⁻¹ day⁻¹. A level of 1.5–2 g kg body weight⁻¹ day⁻¹ was recommended. The use of supplements was discouraged.

When these requirements had been achieved all athletes were put on a 7-week course of 140 mg week⁻¹ methenolone acetate. They were given printed sheets detailing the effects of anabolic steroids, their need to work hard and to eat well. They were instructed to return for review at the end of the 7-week period and definitely not later than 2 weeks after the end of the course when body composition and blood testing were repeated. Following a steroid-free interval of a length at least equal to the duration of the course, a second course was discussed. The anabolic agent used was determined after considering the athlete's views and the availability of material. The drugs used were confined to those available through registered pharmacies when prescribed by a medical practitioner registered in the state of New South Wales. No black market sources were used. The total dose did not exceed 500 mg

week⁻¹. No prescription provided more than a 9-week course of anabolic steroid. Every course was preceded by estimation of body composition and blood testing for comparison with the results at the end of the course.

Student's *t* test for paired data was used for statistical analysis of the results using NWA Stat Pak (Northwest Analytical, Portland, Oregon, USA).

Results

The aims of those attending varied considerably. Most (64%) were weight-training for body building as their sole activity. These were mainly casual athletes who trained initially for the pleasure of it and sometimes competed in low-level competitions as a motivational technique. One-quarter were using strength development to improve their chosen sports. They attended during the off season and wanted to improve their performance on the field as a result of gaining increased strength and increased weight. None of them were high-level players but they all felt that greater strength and more weight were a desirable combination, particularly in contact sport. There was a significant number (11%) of 19–21-year-old athletes who were thin and small in build, weighing in the 50–60 kg class, who felt that their body image was inadequate, it interfered with their ability to attract the female sex and was the basis of jibes at work. A number of the attenders were homosexual and used the training programme to improve their body image. The group from 35 to 60 years of age (12%) was motivated by an urge to tone-up the body, a desire not to get fat and in a few cases an intention to compete in Masters competitions.

The numbers of participants, their age, weight and height characteristics are shown in Table 1. Changes that occurred in blood chemistry after the first course are shown in Table 2. Changes with oxymetholone paralleled those of the methenolone group. There were no significant changes in those using testosterone esters. Nandrolone decanoate caused variable changes in HDL but these did not reach the 0.05 level of significance.

Weight and body composition analysis showed gains in lean mass up to 9 kg on the first course. The mean weight gain was 2.1 kg. Body composition analysis showed significant loss of fat in those with body fat of 16% or over. Failure to gain weight was mainly due to poor training and inadequate diet.

Table 1. Patient numbers, age, height, weight and percentage body fat and lean body mass

Patient attributes	1987 n = 43	1988 n = 44	1989 n = 82
Age (years)	24(5.26) (19–52)	24.1(5.00) (19–42)	25.1(4.70) (19–49)
Height (cm)	179(6.55) (159–189)	179(6.42) (163–190)	180(7.00) (162–191)
Weight (kg)	83.2(11.70) (56–124)	83(11.90) (56–120)	82(9.90) (59–116)
% Fat	14.4(3.80) (8–31)	11.9(4.15) (8–24)	12.8(4.10) (9–22)
% Lean	85.6(3.80) (69–92)	85.8(3.75) (75–92)	86.1(3.1) (78–91)

Values are mean(s.d.) (range)

Table 2. Biochemical parameters before and after first steroid course

	Before use	After use	Significance
AST	32.7(16.7) (4–118)	41.8(23) (4–176)	< 0.01
ALT	32.2(22.4) (3–135)	43.7(33.6) (4–338)	< 0.01
AlkP	85.8(27.1) (23–187)	88.6(79) (29–992)	n.s.
LDH	468(130) (156–1064)	459(125) (188–1086)	n.s.
Bilirubin	9.6(5) (4–32)	9.8(5.8) (4–37)	n.s.
Cholesterol	4.6(1.0) (2.2–8.4)	4.8(1.2) (2.1–8.8)	< 0.05
HDL	1.17(0.4) (0.27–2.67)	0.93(0.42) (0.13–2.2)	< 0.01
Triglyceride	1.27(0.69) (0.2–4.12)	1.35(0.7) (0.2–4.0)	n.s.

Values are mean(s.d.) (range); n.s. not significant; Student's *t* test

Table 3. Steroids used and average weekly doses

Substance	Numbers	Weekly dose (mg)
Methenolone	284	140
Oxymetholone	62	350
Testosterone undecanoate	24	420
Nandrolone decanoate	44	100
Testosterone esters	56	178
Testosterone ester + nandrolone decanoate	33	278

Table 4. Frequency of courses of anabolic steroids in each annual group until December 1991

Courses	1987	1988	1989
1	51	55	53
2	16	18	22
3–5	13	14	17
6–8	12	12	8
9–10	8	1	0

The frequency of patient consultations varied. The mean period between visits over the whole period was 5 months (range 6 weeks–14 months). The modal value was 7 months. The variety of anabolic agents, frequency of use and the doses used are shown in Table 3. Frequency of courses is shown in Table 4.

Discussion

The need for a new approach to anabolic steroid use in sport is apparent. Their use has been increasing over the last 20 years in spite of all warnings. Prohibition did not solve the alcohol problem and will not solve the anabolic steroid dilemma. Athletes rely upon unscientific literature published by uncritical writers. They consider any risk involved is small and damage will not happen to them. An acceptance of the facts facing the medical world is necessary and a different approach is needed for some degree of control. The adoption of the 'least worst option'¹² is one such approach to reduce the use of drugs and for medical consultations to reinforce the need for hard training and adequate diet.

The number of athletes attending doubled during 1989 due to the publication in Australia of the report of the Senate Standing Committee on drugs in sport¹³. This received wide publicity during its hearings and when the report was presented. Like all reports in this area, it recommended a punitive approach with no help to try to diminish the problem. Great emphasis was placed on side-effects and fatal episodes and this made athletes more aware of the problems but did not deter them in their drug use. They believed that medical science could detect problems early and they would remain safe – a state of mind that arose as a result of reading their anabolic steroid bibles.

The decision not to supply athletes under 19 years of age with anabolic steroids was based on the belief that steroid usage would lead to early epiphyseal closure. A few extra centimetres in height would be an advantage later in life for body builders and athletes in contact sports. This decision flies in the face of reports where oxandrolone was used to speed up the growth of boys with short stature^{14, 15}. Increased growth rate without skeletal maturation was reported. These studies do not support the view that steroids stunt growth although it must be recognized that what happens with short stature may not be reproducible in apparently normal males aged 16 to 19 years. Further study is needed in this area.

Most 'authorities' in the gymnasium recommend stacking procedures, using several drugs together in increasing and then decreasing doses during a course. There is no scientific evidence for its effectiveness over any other dosage pattern. This was countered in initial discussion by suggesting that the increasing level of drug given at 3 weeks did not improve performance; the improvement that occurred about that time was the delayed effect of the first week's dose. It was pointed out that stacking increased blood levels and was likely to have an adverse effect on liver enzymes. Phillips states 'Research shows strength decline can be slowed by proper cycling' although he produces no evidence for this¹⁶.

It was interesting that 51% of attenders did not continue beyond the first course. Of the dropouts, 15% regarded the dosage as being too low or the course too short. Of the attenders, 35% consciously decided not to proceed as they were disappointed with the effects, worried about side-effects or had reached a target weight. Dropouts occurred due to seasonal sports preventing adequate weight-training in season and at times a lack of finance to fund their drug supply.

The opinions and attitudes of athletes continuing in the programme altered slowly over the period. Initially there were demands for rapid results, higher doses and preferably injectable materials. The use of body composition analysis was a valuable tool in management as it demonstrated gains in muscle mass not apparent on the weighing scales and only at times in the mirror. Over the 5 years the pressure for larger anabolic doses decreased and there was increasing interest in better training programmes and improved diet. Gains and losses fluctuated particularly in body building where there was weight loss in the

precompetition period. Influenzal symptoms were developed by 22% of participants during their course which reduced their training schedules and lessened weight gain.

The assessment of work intensity is difficult as so much relies on the athlete's word. The estimation of creatine kinase (CK) before and after the course was useful at times when it showed marked rises, suggesting a heavy work load. A gain in strength was almost invariable (97% claimed increased strength) according to the athletes but its assessment in practice is time consuming and further study of CK level change as a marker is indicated.

The choice of material for the second and subsequent courses was made in consultation with the athlete. They had a propensity to use testosterone esters in several forms at one time. Discussion allowed an explanation of the duplication and encouraged a continuance of a low-dose policy. Testosterone by mouth with its short half-life was discouraged, except on training days, as was the routine use of tamoxifen and chorionic gonadotrophin. As there is so little research on the effectiveness of drugs and the advisable variation in doses it was difficult to persuade users to maintain the required dosage schedules when all the athletes' reading convinced them otherwise.

The substances indicated in *Table 3* all had similar side effects but a given dosage had varying effects in different athletes. Intensity of training was the most positive stimulus for gain but even in those reporting high intensity, benefits were not always achieved with low doses and a higher dose produced a response. There was variability in response to different substances in different athletes. It was important to explain that large gains cannot be maintained with each course as too high an expectation leads to dissatisfaction. In selecting a dose, previous experience was helpful to keep it at a level that produced gains with minimal side effects. With carefully graduated amounts a satisfactory progressive response could be achieved.

The results of the initial blood testing eliminated a number of people from the programme. There were 19 people with fasting cholesterol levels above 6 mmol l^{-1} and they were referred for the appropriate advice. Two of these have returned and have followed the programme satisfactorily without a recurrence of the abnormal levels. Before starting there were eight athletes with AST levels well above the normal range. Three of these were associated with positive Hepatitis B tests, two had evidence of chronic hepatitis of unknown cause. No cause was found in the others for this raised level and on review, after 3 months, levels had come down to the normal range and anabolic agents were then prescribed without any further problems. Following the administration of the first course of anabolic agent AST, ALT, cholesterol and HDL levels were significantly altered as a result of the use of the anabolic agent. This is in line with previous studies. Haupt and Rovere¹⁷ concluded that AST and ALT rises were non-specific and the liver effects would be better determined by assessing LDH and AlkP levels. However, in this series, any changes in those

enzymes were not statistically significant. Alen¹⁸ found no rises in AST and ALT levels throughout although his group had used the material for considerably longer than in the present programme. There were four athletes all from the same training gym whose ALT levels were within the region of 250 to 338 units after the course. This was far in excess of any other individual and following questioning the athletes disappeared and were not seen again except for one athlete who returned in 6 months and confirmed that his group had taken extra blackmarket steroids in addition to the ones that were prescribed. This athlete has since remained in the programme and similar enzyme levels have not been seen again.

Changes in cholesterol were significant statistically but, as the blood samples were not taken fasting for logistical reasons, there may be no significant change in fasting levels before and after the programme. HDL levels were significantly reduced. This has been a marker in those who used C-17 substituted anabolics. The changes in the serum levels returned to normal in 6 to 12 weeks.

The use of combined testosterone esters was popular as they have a reputation for increasing muscle bulk. Blood studies using the same testing format showed no significant changes with the use of testosterone esters in agreement with Kuipers¹⁹ and the World Health Organization²⁰. This view however was not supported by Van der Zon²¹ who stated 'the use of testosterone invariably results in a substantial decrease of HDL'.

Subjective side-effects have not been a problem because of the short duration of the study. The progression of the dose is probably a factor as it educates the athlete to monitor his own body systems, to be aware of any tendency towards aggression and there is not time for a major build up of emotional tensions. It is reasonable that the athlete's chemical processes also slowly adapted to the increased amount of anabolic agent. Immediately on cessation of the drug any aggressive tendency decreases.

Libido responded variably. When decreased, some emotional disturbance occurred at the time but as all symptoms disappeared on cessation no long-term problem arose. It is worth noting that three of the athletes sired children during the period in which they were taking the anabolic agents. There were three cases of gynaecomastia which settled down well when treated with a daily dose of 20 mg tamoxifen over a period of 4 weeks. The small to moderate steroid doses used were probably a factor in conditioning the body to handle oestrogens, and also the short course did not give the opportunity for a high level of oestrogen to be maintained to produce the gynaecomastia. Two athletes developed gynaecomastia a month after ceasing their course. Only one case of hypertension was found. This was in an athlete who, having obtained the prescription and taken the tablets for 2 days, visited his family doctor who found hypertension to be present. The athlete has not been seen again but it seems unlikely that in 2 days a small amount of methenolone could produce a hypertension which was not present 2 days before.

Lean body mass gain was not always apparent to

athletes early in the programme although weight increased. This was evident after 9–12 months in those who worked in a heavy programme. The ectomorphic light-weight participants were difficult to impress as their gains were small in comparison with their larger counterparts in the training arena. Their gains were relatively equivalent to the larger participants but did not show up in the mirror – the bodybuilder's measuring stick. Those using anabolic steroids for performance enhancement in strength sports were easier to satisfy as strength was their paramount need.

In conclusion, this series shows that doses of anabolic steroids regarded as small by the black-market regime can be used in athletes without any significant problem in the short term – up to 5 years. Medical administration of a programme gives an opportunity for athlete education in benefits and side-effects and allows improvement in dietary and exercise programmes. This has led to better weight and bulk gains and a reduction in anabolic steroid use compared with the usage in gymnasia.

The general community perception of 'once a user always a user' is incorrect. With good medical knowledge and careful explanation athletes can gain confidence in our profession again with the opportunity to reduce the harm caused by practices developed on the blackmarket solely for profit of the provider. These practices lead to more side-effects, and catastrophic events are attributed to the use of anabolic steroids rather than their abuse.

Professional and Olympic associations are known for words and no action. Hypocrisy is rife. Law enforcement has failed. New drugs are becoming available. Is this not the time to direct our disgust and blame towards understanding and education? Medical management will provide the best answer to harm reduction.

References

- 1 Jones A. *The Jerusalem Bible*. London, UK: Darton Longman and Todd, 1968: 7.
- 2 Cszaky TZ. Doping. *J Sports Med Phys Fitness* 1972; **12**: 117–23.
- 3 Corder BW, Dezelaky TL, Toohey JV *et al*. An analysis of trends in drug use behaviour at five American Universities. *J School Health* 1974; **44**: 386–9.
- 4 Buckley WE, Yesalis C, Friedl KE, Anderson WA, Streit AL, Wright JE. Estimated prevalence of anabolic steroid use among male high school seniors. *JAMA* 1988; **260**: 3441–5.
- 5 Perry HM, Wright D, Littlepage BNC. Dying to be big: a review of anabolic steroid use. *Br J Sports Med* 1992; **26**: 259–61.
- 6 Fost N. Banning drugs in sports: a skeptical view. *Hastings Centre Report* 1986; **16**: 5–10.
- 7 Sarno T. Athletes stayed in games after a positive drug test. *Sydney Morning Herald*, 19 November 1988: 33.
- 8 Voy R. *Drugs, Sport, and Politics*. Champaign, Illinois, USA: Leisure Press. 1991: 101–13.
- 9 Batey R. The war against drugs. Why the war is not being won. *Med J Aust* 1991; **155**: 26–8.
- 10 Duchaine D. *Underground Steroid Handbook*. Venice, California, USA: ALR Technical Books, 1989.
- 11 Perry PJ, Andersen KH, Yates WR. Illicit anabolic steroid use in athletes – a case series analysis. *Am J Sports Med* 1990; **18**: 422–8.
- 12 Chesher G. Designer drugs – the 'whats' and 'whys'. *Med J Aust* 1990; **153**: 157–61.
- 13 Australian Government Senate Standing Committee on Environment, Recreation and the Arts. *Drugs in Sport, Second Report: 1990*. Canberra ACT, Australia: Australian Government Publishing Service, 1990: 21–36.
- 14 Moore DC, Tattoni DS, Limbeck GA *et al*. Studies of anabolic steroids: V. Effect of prolonged oxandrolone administration on growth in children. *Pediatrics* 1976; **58**: 412–22.
- 15 Pope HG, Katz DL. Affective and psychotic symptoms associated with anabolic steroid use. *Am J Psychiatry* 1988; **145**: 487–90.
- 16 Phillips WN. *Anabolic Reference Guide*, 6th ed. Golden, Colorado, USA: Mile High Publishing, 1991: 69–79.
- 17 Haupt HA, Rovere GD. Anabolic steroids: a review of the literature. *Am J Sports Med* 1984; **12**: 469–84.
- 18 Alen M. Androgenic steroid effects on liver and red cells. *Brit J Sports Med* 1985; **19**: 15–20.
- 19 Kuipers H, Wijnen JAG, Hartgens F *et al*. Influence of anabolic steroids on body composition, blood pressure, lipid profile and liver function in body builders. *Int J Sports Med* 1991; **12**: 413–8.
- 20 World Health Organization Task Force on methods for the regulation of male fertility: contraceptive efficacy of testosterone-induced azoospermia in normal men. *Lancet* 1990; **336**: 955–9.
- 21 Van der Zon P. Safety of testosterone enanthate. *Lancet* 1990; **336**: 1517–8 (Letter).

Overstressed? Overstrained? Overlooked? OVERUSE INJURIES OF THE LOWER LIMB

21st Annual Conference of the ACPSM; Nottingham University 9–11 September 1994

The Conference is intended for physiotherapists, GPs and other professionals supplementary to medicine who are involved in the assessment and treatment of sports injuries. The programme will comprise an introductory address by Mr John Aldridge followed by linked sessions on functional anatomy & biomechanics of the foot, orthotic indication & prescription, anterior knee pain (revisited), "shinsplints" (differential causes of pain in the lower leg), differential groin diagnoses, and back injuries in sport. Practical workshops will take place on the Saturday afternoon. Fully res. w/e prices from £90, part options available. For further information contact Lynda Daley, 65 Station Rd, Castle Donington, Derbys. DE74-2NL Tel.0602-721319