Early Myocardial Dysfunction After Chronic Use of Anabolic Androgenic Steroids: Combined Pulsed-Wave Tissue Doppler Imaging and Ultrasonic Integrated Backscatter Cyclic Variations Analysis


Background

Androgenic anabolic steroids (AAS) are a major group of doping drugs used by bodybuilders to increase lean body mass and muscle strength. Long-term use of AAS has been associated with functional and toxic multiple-organ alterations, such as cardiovascular diseases, including an increase in left ventricular (LV) mass, hypertension, arrhythmia, myocardial infarction, cerebral stroke, and sudden death. The link between intensive training and AAS use in causing heart hypertrophy is well known. However, the effects of chronic consumption of AAS on cardiovascular structures and function are still a matter of debate. Biopsy data have shown that in athletes under the pharmacologic effects of AAS, a focal increase in myocardial collagen content might occur as a repair mechanism against myocardial damage.

Pulsed-wave Doppler tissue imaging (PWTID) detects early regional alterations of ventricular function, whereas integrated backscatter cyclic variations (IBScv) are tightly related to the contractile efficiency of the left ventricular wall.

Aim

The aim of this study was to identify the effects of chronic AAS misuse on myocardial function using both PWTID and IBScv.

Material

Twenty-eight male bodybuilders (11 AAS users, 17 AAS nonusers) and 20 healthy sedentary subjects (controls), matched according to age, were studied.

Table 1: Training programs of the bodybuilders

<table>
<thead>
<tr>
<th>Variable</th>
<th>AAS users (n = 11)</th>
<th>AAS nonusers (n = 17)</th>
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</thead>
<tbody>
<tr>
<td>Sessions per week</td>
<td>5.45 ± 0.82</td>
<td>3.65 ± 0.99</td>
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<tr>
<td>Aerobic exercise (min/km)</td>
<td>11.9 ± 0.6</td>
<td>6.0 ± 3.10</td>
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<tr>
<td>Anerobic exercise (min/km)</td>
<td>4.8 ± 1.2</td>
<td>4.50 ± 0.66</td>
</tr>
<tr>
<td>Years</td>
<td>5.0 ± 0.8</td>
<td>6.0 ± 2.76</td>
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<tr>
<td>Starting age</td>
<td>44.9 ± 2.9</td>
<td>21.47 ± 3.54</td>
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</table>

Data are expressed as mean ± SD.

Methods 1: Tissue Doppler imaging (TDI)

To assess left ventricular function, each subject underwent standard Doppler echocardiography, PWTDI, and IBScv analyses.

Tissue Doppler imaging (TDI) is a variation of conventional Doppler. The systolic and diastolic velocity of myocardial region can be studied with pulsed wave tissue Doppler sampling, which displays the velocity of a selected myocardial region against time with high temporal resolution.

Results 1 - Standard Echocardiogram

On PWTD analysis, AAS users showed regional systolic and diastolic dysfunction (evaluated by measuring s', e', and a') not detectable in the other two groups. Multivariate linear regression analysis showed that AAS use was an independent predictor of regional diastolic dysfunction (odds ratio, 30; 95% confidence interval, 2.9-306; P = .005).

Results 3

IBScv identified regional systolic impairment only in AAS users at the level of the left ventricular inferior wall. Stepwise multivariate linear regression analysis on standard echocardiographic parameters and PWTDI data identified AAS use as an independent factor related to IBScv (b = 0.65, SE = 0.65, P < .001).

Conclusions

The present study confirms that in AAS users, PWTDI and IBScv are effective and reliable noninvasive diagnostic tools for detecting early abnormalities of the systolic and diastolic longitudinal myocardial function, probably related to an increase in myocardial collagen content, interpretable as a repair process against the direct cellular injury produced by AAS.