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RELATIONSHIP BETWEEN THE USE OF ANABOLIC STEROIDS AND OCCURRENCE OF CARDIOVASCULAR EVENTS IN ADULTS: A LITERATURE REVIEW

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Abstract: Introduction: Anabolic androgenic steroid hormones (AAS) are derivatives of testosterone, produced mainly in the testes in men and in the ovaries and adrenal glands in women. Initially used during the Second World War to increase the aggressiveness of soldiers and for therapeutic purposes, EAA became popular among athletes to improve sports performance. Currently, its use is common among recreational athletes, especially young people, despite the unknown or underestimated risks to cardiovascular health. **Method**: This literature review was conducted in six stages, including topic selection, definition of inclusion and exclusion criteria, and critical evaluation of studies. The research was carried out at BIREME, using the VHL and databases such as PubMed and Cochrane. 127 articles were found, of which, after applying the inclusion and exclusion criteria, 5 were selected for analysis, in addition to information from ABC Cardiol. **Results and discussion**: The review identified several negative impacts of EAA use on the cardiovascular system, such as atherosclerosis, hypertension, myocardial necrosis, heart failure, thromboembolism and arrhythmia. Theoretical models explain these effects by changes in lipoprotein levels, increased platelet aggregation, vasospasm and myocardial injuries. **Conclusion**: The use of EAA represents a significant risk to cardiovascular health, evidenced by several studies that link these substances to adverse cardiac events. The high incidence of heart attack and chronic arterial disease among adolescents and adults reinforces the need to discourage the use of AAS. Therefore, it is crucial to warn about the serious and potentially fatal risks of these substances.

INTRODUCTION

Anabolic androgenic steroid hormones (AAS) are derivatives or precursors of testosterone. Its natural production occurs predominantly in the testicles in men and in the ovaries and adrenal glands in women, and, to a lesser extent, in peripheral tissues through the conversion of androstenedione. They are responsible for the secondary sexual characteristics associated with masculinity and directly linked to the protein synthesis process. (ROCHA et. al, 2023).

The use of EAA began with German troops during the Second World War, with the aim of increasing the aggressiveness of soldiers and, for therapeutic purposes, in the treatment of people with burns, depression, chronic weakness and in recovery from major surgeries (FERREIRA et. al, 2007).

After 1950, EAA began to be used unrestrainedly by athletes, mainly bodybuilders and weightlifters, in order to improve sporting performance, requiring the intervention of the International Olympic Committee, which vetoed the use of these substances for doping purposes (ROCHA et. al, 2023).

Currently, the use of EAA is becoming popular among recreational athletes, especially among teenagers and young adults, to gain muscle mass quickly. The worrying thing is that many of these users seem to not believe or are unaware of the side effects that the use of these substances can cause (PINTO et. al, 2021).

Numerous side effects can be caused by the use of EAA for aesthetic and non-therapeutic purposes, and many of these effects are still unknown or poorly recorded in the literature, as randomized controlled studies using supraphysiological doses of these substances in humans are scarce. It is known that the indiscriminate use of EAA can affect several organs and systems of the human body, especially the cardiovascular system, which can cause elevated blood pressure, decreased diastolic function and cardiac hypertrophy (ABRAHIN; SOUSA, 2013).

The objective of this study is to analyze the existing literature on the relationship between the use of anabolic steroids and the occurrence of cardiovascular events in adults.

METHOD

The study is a narrative review carried out in six stages: selection of the topic and elaboration of the research question; establishment of inclusion and exclusion criteria for the search; evaluation and critical analysis of included studies; analysis and synthesis of included studies with interpretation of results; and presentation of the review.

This article is a narrative review that aims to analyze the existing literature on the relationship between the use of anabolic steroids and the occurrence of cardiovascular events in adults. The search was conducted through the Regional Library of Medicine (BIREME) using the Virtual Health Library (VHL) and included databases such as PUBMED (National Library of Medicine) and Cochrane.

Using the keywords "adults", "anabolic androgenic steroid" and "cardiac events", without restriction of any criteria, 127 articles were found in the following databases: PubMed (n=125) and Cochrane (n=2). When carrying out the search, the inclusion criteria were: languages in English, Portuguese and Spanish, published in the last 5 years, complete and free articles and articles with patients between 19 and 44 years old and those with exclusion criteria were: publications in PowerPoint (PPT), those without a date, editorials, letters to the reader, letters to the editor without case reports, articles with unclear methodology, publications that did not fit the desired focus and articles with patients under 19 years of age and over 44 years of age. After applying the inclusion and exclusion criteria, 122 articles were excluded.

After excluding the publications mentioned, we selected 5 scientific articles for analysis in addition to the information available on the topic in ABC Cardiol, a monthly publication of the Brazilian Society of Cardiology. Based on this selection, we classify, compile and direct the articles according to the objectives of constructing the final article. Subsequently, we summarize the results found taking into consideration, the similarity of content.

RESULTS AND DISCUSSION

This article sought to analyze the literature's approach to the available evidence on the relationship between the use of anabolic steroids and the occurrence of cardiovascular events in adults. Through a careful survey of the literature on the subject, it was possible to list the different impacts that the use of these substances can have on the cardiovascular system when used illicitly, both for aesthetic purposes and to improve performance in sports, among cardiac diseases and events. they areatherosclerosis, hypertension, myocardial necrosis, heart failure, hypertrophy, thromboembolism and arrhythmia (MUSTAFA et. al, 2020).

Melchert and Welder presented four theoretical models to explain the cardiovascular side effects caused by anabolic steroids: atherogenic, thrombotic, vasoconstrictive and myocardial injury. The atherogenic model discusses changes in serum lipoprotein levels, which increases the risk of atherosclerosis. The second involves increased platelet aggregation and polycythemia, which predisposes to thrombus formation. The vasoconstrictor model concerns the vasospasm suffered due to the release of nitric oxide induced by anabolic agents. Finally, the fourth model says that the increased toxicity caused by myocardial injuries generates apoptosis of cardiac tissue cells, which increases the fibrotic process in the muscle (TORRISI et. al, 2020).

Among the heart diseases analyzed, the high incidence of acute myocardial infarction in users of anabolic steroids stands out due to the change in lipid profile and atherosclerosis that these individuals develop earlier. There are studies that indicate that the prevalence of chronic arterial disease in anabolic steroid users with an average of 39 years of age is approximately 50%, which points to premature development of atherosclerosis, as the prevalence found in non-users of this age group is approximately 3% (BUHL et. al, 2024).

Studies indicate that anabolic steroids cause chronic arterial disease due to systemic and coronary artery inflammation. Inflammation of the vessels is the trigger for the development of coronary atherosclerotic plaque. Therefore, the main markers of systemic inflammation, such as IL-1, IL-6, and TNF-α, which are the main factors that act in the vascular inflammatory cascade, are found at higher levels in users of anabolic steroids when compared to non-users (SOUZA et. al, 2023).

It is also important to highlight the potential increased risk of sudden death. The cardiac changes most frequently noticed in anabolic steroid users include myocardial fibrosis and necrosis, cardiomegaly, left ventricular hypertrophy, atherosclerosis, inflammatory infiltrate, coronary stenosis and left ventricular apoplexy, presented in this order, from most common to least common. All of these changes represent a pro-arrhythmic substrate and predispose to the presence of ischemia of the cardiac tissue, thus being directly linked to the greater predisposition to the occurrence of sudden death (TORRISI et. al, 2020).

Furthermore, case reports available in the literature report a significant association between the use of anabolic steroids and the development and even exacerbation of heart failure. It is also essential to emphasize that there is no safe relationship regarding the dose and time of use of these substances, however, it is known that cardiovascular damage is proportional to these two factors. Even at doses considered low or in short periods of use, anabolic steroids can cause significant damage to the heart and this damage increases as the time of use and dose used increases. Thus, the perception that moderate or short-term use of EAA is safe is mistaken and does not find support in current scientific literature (SKORUPSKA et. al, 2022).

Finally, it is possible to conclude that the illicit use of anabolic steroids is a growing public health problem. The global population must be even more alert, especially young people and recreational athletes who are the biggest users, who are at increased risk of acute coronary syndromes, sudden death and other diseases (MELHEM JR. et. al, 2020).

CONCLUSION

This literature review reinforces the statements made by the Federal Council of Medicine of Brazil and specialty societies refuting the use of these substances for aesthetic purposes or to obtain sporting benefits. The illicit use of anabolic androgenic steroids (AAS) represents a serious risk to cardiovascular health, evidenced by several studies that link the use of these substances to various adverse cardiac events. Among the main effects are early atherosclerosis, hypertension, myocardial necrosis, heart failure, thromboembolism and arrhythmias.

The high incidence of acute myocardial infarction and chronic arterial disease among AAS users, especially young people and recreational athletes, highlights the urgent need for awareness and preventive interventions by authorities and regulatory bodies. Evidence suggests that even moderate doses or short periods of use are not safe, with cardiovascular damage increasing proportionally to the time and dose of use.

Therefore, it is essential to reinforce the recommendations of medical and sporting entities against the non-therapeutic use of anabolic steroids, warning about the significant and potentially fatal risks of these substances.

REFERENCES

Abrahin, Odilon Salim Costa e Sousa, Evitom Corrêa de. Esteroides anabolizantes androgênicos e seus efeitos colaterais: uma revisão crítico-científica. **Revista da Educação Física / UEM [online]**. 2013, v. 24, n. 4 [Acessado 18 Julho 2024], pp. 669-679. Disponível em: <https://doi.org/10.4025/reveducfis.v24.4.17580>. Epub 03 Jun 2014. ISSN 1983-3083. https://doi.org/10.4025/reveducfis.v24.4.17580.

Buhl, Laust Frisenberg et al. "Impact of androgenic anabolic steroid use on cardiovascular and mental health in Danish recreational athletes: protocol for a nationwide cross-sectional cohort study as a part of the Fitness Doping in Denmark (FIDO-DK) study." **BMJ open** vol. 14,5 e078558. 7 May. 2024, doi:10.1136/bmjopen-2023-078558

Gomes Ferreira, Urival Magno, Dias Ferreira, Alan de Carvalho, Pires Azevedo, Andréa Maria, Lucena de Medeiros, Rafaella, da Silva Carlos Antonio Bruno . Esteróides anabólicos androgênicos. **Revista Brasileira em Promoção da Saúde [online]**. 2007, 20(4), 267-275[fecha de Consulta 18 de Julio de 2024]. ISSN: 1806-1222. Disponível em: https://www.redalyc.org/articulo.oa?id=40820411

Melhem, Abrão José Jr et al. "Acute Myocardial Infarction in a Young Bodybuilder: A Case Report and Review of the Literature." **The American journal of case reports,** vol. 21 e924796. 27 Aug. 2020, doi:10.12659/AJCR.924796

Mustafa, Eliana M et al. "AMI and Anabolic-Androgenic Steroids: Case Report with Systematic Review." **Current cardiology reviews,** vol. 17,5 (2021): e190721189769. doi:10.2174/1573403X16999201231203405

Pinto, Renata Machado ; Venâncio , Lucas Gonçalves ; Pereira, Lucca de Almeida Andrade ; Jacinto , Rafael Abrantes; Santos, Italo Santiago Dos ; Uchôa, João Bruno Machado ; "O desconhecimento acerca dos Esteroides Anabólicos Androgênicos e seu uso indiscriminado", p. 145-147 . In: **Anais do V Congresso de Escolas Médicas**. São Paulo: Blucher, 2021. ISSN 2357-7282, DOI 10.5151/cesmed2021-46

ROCHA, G. C. de L.; DA SILVA, C. C.; NERES, E. G. da S.; PEIXINHO, A. L. S. S.; DA COSTA, J. E. P.; CAVALCANTE, L. B. Revisão bibliográfica sobre a testosterona. **Brazilian Journal of Health Review**, [S. l.], v. 6, n. 5, p. 20751–20762, 2023. DOI: 10.34119/bjhrv6n5-109. Disponível em: https://ojs.brazilianjournals.com.br/ojs/index.php/BJHR/article/view/62956. Acesso em: 18 jul. 2024.

Skorupska, Katarzyna et al. "Disastrous effects of anabolic steroid abuse: a peculiar case of heart failure and toxic hepatitis in a young bodybuilder." **Polish archives of internal medicine,** vol. 133,1 (2023): 16355. doi:10.20452/pamw.16355

SOUZA, Francis Ribeiro de; ROCHITTE, Carlos E.; SILVA, Douglas Carli; SAMPAIO, Barbara; PASSARELLI, Marisa; SANTOS, Marcelo R. dos; FONSECA, Guilherme W.; BATTAGLIA FILHO, Antonio Carlos; CORREA, Kelly; VAL, Renata Margarida do; YONAMINE, Maurício; PEREIRA, Rosa Maria R.; NEGRÃO, Carlos Eduardo; KALIL-FILHO, Roberto; ALVES, Maria Janieire de Nazaré Nunes. Inflamação Coronária Avaliada pela Atenuação de Gordura Pericoronária na Tomografia Computadorizada e Elevação de Citocinas em Usuários Jovens de Esteroides Anabólicos Androgênicos. **Arq. Bras. Cardiol.,** v. 120, n. 11, e20220822, nov. 2023.

Torrisi, Marco et al. "Sudden Cardiac Death in Anabolic-Androgenic Steroid Users: A Literature Review." **Medicina (Kaunas, Lithuania),** vol. 56,11 587. 4 Nov. 2020, doi:10.3390/medicina56110587