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TWO FACES OF ANABOLIC STEROIDS

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Abstract : Derivatives of testosterone are called anabolic steroids. Testosterone was first synthesized to treat depression by German scientists in the 1930's.Anabolic use was first seen in the 1954 during the Olympics. They are used for building muscle or increasing strength and endurance in certain sports which give the athlete an advantage over their competitor. Anabolic work by increasing the protein synthesis in the human body which results in increase in size and strength but they also come with some side effects and may lead to complications if abused. Though primarily used for hormonal therapy which improves a person's overall health steroids are now being used a drug of abuse which has become common in today's young generation.

IndexTerms **– anabolic steroids, testosterone, body building steroids, side effects of steroids, clinical indications of steroids.**

I. INTRODUCTION

Anabolic steroids belong to a class of synthetically derived steroids that bind to androgen receptors and mimic the action of testosterone, leading to anabolic effects. It increases muscle growth.

The primary male sex hormone is testosterone, which is secreted by Leydig's cells in the testes. At puberty, the body's testosterone levels rise, and this is what causes the development of secondary sex features such as the deepening of the voice, pubic hair growth, development of the sexual organs, maturation of the sperm, increased libido, and increased sebaceous gland oil production. All these effects are known as "androgenic effects" of the hormone. [1]

Abbreviations and Acronyms

DHT: - Dihydrotestosterone
GH: - Growth hormone
IGF-1:- Insulin-like growth factor 1
HRT: - Hormone replacement therapy
TRT: - Testosterone replacement therapy
LDL: - Low-density lipoprotien
HDL: - High-density lipoprotein
MG: - Milligram

II. ANABOLIC FAMILY

Anabolic steroids can be classified as 3 types: dihydrotestosterone (DHT) and its derivatives, testosterone and its derivatives, nandrolone and its derivatives. DHT which is responsible for hair loss is used as a drug to increase muscle mass and its derivatives include drugs like primobolan and anavar which are used for muscle growth, testosterone derivatives. Testosterone the primary sex hormone has many functions but when used in supra-physiological doses gives anabolic effects the derivatives include equipoise and halotestin. Finally nandrolone or 19 nor testosterone is also a drug when used in higher dosages gives an anabolic effect its derivative trenbolone is one of the strongest drugs to provide anabolic effects but also with higher toxicity.

III. MECHANISM OF ACTION

Elevated testosterone exerts "anabolic effects" that accelerate protein synthesis and promote growth. The major target organ of anabolic steroids is the skeletal muscles. The testosterone molecule interacts with the receptor. During this contact, the testosterone molecule will form a bond with the cytosolic intracellular receptor site, creating a new "receptor complex." Actin and myosin, the two primary contractile proteins, will be synthesised faster in skeletal muscle cells as a result of this complex's migration to the cell nucleus and activation of specific genes present (muscular growth). Hence they are used to improve athletic performance. [2]

Additionally, androgen receptors are upregulated and amplified by anabolic steroids, allowing for higher training loads and indirectly resulting in bigger, stronger muscles. They have a variety of effects on other central nervous system neurotransmitters. Also,

they stimulate the brain by antagonistically opposing glucocorticoids, causing decrease in glucose synthesis. [3][4] The effects of glucocorticoids are attenuated when the growth hormone-insulin-like growth factor-1 axis is stimulated. [5] The activation of GH by androgens and the hepatic synthesis of IGF-1 lead to the production of muscle proteins and anabolic effects. Additionally, testosterone affects bone and muscle mass gain, puberty, and sexual function by converting via the action of the enzyme aromatase to estradiol and estrone. As a result of the down-regulation of androgen receptors, high steroid dosages have an anti-estrogenic impact.

Adipose (fat) tissues also respond to androgen, these hormones support the ability of cells to mobilise fat through a process called lipolysis. [6] This mechanism is regulated by beta-adrenergic receptors. The body's testosterone levels and the amount of body fat stored in the body are inversely correlated. The deposition of body fat will normally increase when the level of androgenic hormones decreases.[7] Since oestrogen plays a compensatory function by working to promote the storage of body fat in numerous sites of action, the ratio of androgen to oestrogen activity is therefore of utmost significance.

Steroids stimulate the skin's sebaceous glands to release oils. The release of oils increases along with the level of androgen. Because the chances of clogged pores increases as oil production rises, acne is a very common adverse effect of steroid use. Androgen receptor stimulation in skin and scalp tissues is also associated with the growth of body and facial hair.

IV. CLINICAL APPLICATION

Mostly every pharmaceutical market in the world has permitted anabolic/androgenic steroids for sale by prescription. These drugs have been used for a number of years to treat a variety of pathological disorders, and as a result, they now have a number of well-established medicinal uses. They have treated a large number of patients, including men and women of almost all ages, from infants to the elderly. The fact that anabolic/androgenic medications have been shown to be life-saving treatments is sometimes forgotten amid the hysteria surrounding steroid usage.

Hypogonadism/Androgen Replacement Therapy

Low levels of testosterone is clinically referred to as hypogonadism. Clinically relevant blood testosterone levels are often considered to be below 350 ng/dL. Androgen replacement therapy is the major clinical indication of anabolic/androgenic steroids. The primary male hormone, testosterone, is supplemented as part of this therapy, which is sometimes referred to as hormone replacement therapy (HRT) or testosterone replacement therapy (TRT), in order to alleviate the symptoms of hypogonadism. The most common symptoms of low testosterone in adult males include decreased libido, erectile dysfunction, tiredness, lack of energy, decreased strength and/or endurance, decreased ability to play sports, mood swings, reduced stature (bone loss), poor work performance, memory loss, and muscle loss. [8] The risk of cardiovascular disease may be minimised by hormone replacement therapy. For instance, research often demonstrates that hormone replacement therapy is beneficial for serum lipids. This entails a decrease in the levels of LDL and total cholesterol with little to no change in the levels of HDL (good) cholesterol. [9]

Hereditary angioedema

Hereditary angioedema is a rare and sometimes fatal immune system disease that is treated with anabolic steroids. It is characterized by a sudden swelling of the lips, eyes, tongue, neck, arms, and legs. Additionally, there may be digestive system swelling, which can cause nausea, vomiting, and cramping in the abdomen. In the most severe situations, the patient may experience throat edema and an obstruction of the airways, which can lead to suffocation and sudden death. Blood clotting factor genetic alterations, which result in hereditary angioedema, affect the level or function of the protein C1 esterase inhibitor.[10] This protein governs C1, a "complement system" protein that is necessary for the regulation of inflammation. Stanozolol and danazol have been the two anabolic steroids that have been used the most commonly. [11]

Anaemia

Insufficient red blood cell production is a defining feature of anaemia. In a drug class known as anabolic/androgenic steroids, the kidneys are encouraged to produce more of the hormone erythropoietin, which promotes the synthesis of new red blood cells. Administration of steroids typically results in an increase in hematocrit and red blood cell count, There are several types of anaemia that are likely to respond to steroid therapy, including those brought on by renal insufficiency, sickle cell disease, refractory anaemias like aplastic anaemia, myelofibrosis, myelosclerosis, agnogenic myeloid metaplasia, and anaemias brought on by cancer or myelotoxic drugs. [12]

Growth failure

Anabolic steroids can be given to children who have growth hormone deficiency. It has been demonstrated that these substances have favourable effects on both bone and muscle growth. If administered before the fusion of the long bones' ends (epiphysis) and the termination of further linear development, their anabolic actions on bone may stimulate an increase in height. This can happen directly via the steroid acting anabolically on bone cells or inadvertently by stimulating the release of growth hormone and IGF-1.[13]

Osteoporosis

Osteoporosis can be treated with anabolic steroids, which enhance bone mineral density. The promotion of new bone formation, prevention of bone resorption (breakdown), and improvement of calcium absorption are all advantages of therapy.[14] The anabolic steroid that is most frequently recommended for the treatment of osteoporosis is nandrolone decanoate. The medication provides advantages for bone density and may lower patients' risk of suffering a bone fracture.[15]

V. USE IN BODYBUILDING

Anabolic steroids are famous in the bodybuilding industry with the standard of physique going higher and higher many young males and females have no option other than to consume these steroids to look a certain way. These steroids help with gaining muscle and losing fat at a faster rate while if done naturally could take years of hard work which these drugs help achieve in a couple of months. Many actors and actresses in Hollywood as well as Bollywood are suspected of abuse of anabolic steroids. This helps them to get a physique for a certain role and they are compelled to take drugs due to pressure of looking good for a role and maintaining an image

to the fans. Lastly there are bodybuilding competitions where people show off their physiques in order to impress the judges and win the competition. As competition increases people tend to use these steroids in very high dosages than recommended which may lead to severe side effects and even death in some cases. A typical bodybuilding dosage looks like testosterone injections ranging from 200 mg to 400 mg in a 7 week period i.e. one injection per week. This also includes cholesterol support and fish oil supplements and oestrogen blockers such as tamoxifen to inhibit any oestrogen side effects. The dosages can increase if the individual wants to have more anabolic effects but also the side effects increase as well.

VI. SIDE EFFECTS OF STEROIDS

Anabolic/androgenic steroid (AAS) use can have a variety of detrimental effects on one's appearance, health, and mental well-being even though they are normally considered as therapeutic medications with significant safety. Almost everyone who misuses anabolic/androgenic steroids for bodybuilding or performance enhancement experiences some sort of negative side effect.[16] Some athletes use alcohol, opiates, cocaine, marijuana, in addition to anabolic steroids. Some of these substances may interact negatively with anabolic steroids.[17]

Steroids in therapeutic ranges don't have much side effects on the cardiovascular system but when used in supra-physiological doses may have side effects. This includes walls of the ventricles thickening, changes in cholesterol which are unfavourable and increase in blood pressure. In the short term, the side effects are very low but in the long term the side effects may add up and lead to serious diseases, stroke and even death. Anabolic may also have adverse effects in the liver and the kidney. In males, anabolic have caused problems such as severe cystic acne which proves to be very uncomfortable to the patient. Males also suffer from hair loss due to the DHT conversion of testosterone this may lead to low confidence and low self-esteem. [18] Gynecomastia enlargement of male breast tissue is also a major problem and can only be resolved by surgical methods. [19] In females this leads to hormonal problems, irregular menstruation cycles etc. The human body when exposed to anabolic for a long time stops its endogenous production thus patients have to rely on TRT or hrt for a lifetime. This also leads to problems with testicular atrophy, low libido or infertility. Some individuals also experience sleep apnea which is a sleep disorder. Steroids also have mental side effects as they elevate the human emotions and may lead to steroid rage, depression anxiety and even criminal activities. [20]

VII. CONCLUSION

Anabolic steroids have clinical uses and can be used to fix some problems in the human body. But in today's age they are used for gaining an advantage in a competition game or self-satisfaction. They are not an easy way out and some individuals may not respond to them at all. Thus they should be used wisely and should not be abused.

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