

"You can't help getting older, but you don't have to remain so if you desire"

Indian population is exploding. According to The World Fact book the population has already reached 1.129 billion in July 2007. The life expectancy is increasing and fertility rates are decreasing. Due to these facts the people above 65 years of age are 57 million and it is expected that biggest increase of population growth will occur in this group.¹

Andropause is medically referred to as Androgen Deficiency Amongst Men (ADAM). The synonyms are Male Menopause; Male Climacteric and Veropause. Andropause may also be referred in the literature as Aging male Hypogonadism or late onset hypogonadism. Typically Andropause is a syndrome affecting the various organs of the body and producing varying symptoms. Overall the quality of life is decreased over the years and the individual considers this as aging. The understanding of Andropause amongst medical professionals dealing with our geriatric populations has not kept pace with the developments in this field. The ultimate sufferer is the patient who is treated by a specialist depending upon dominance of symptoms related to the particular specialty but often overlooking andropause.

My search, over the last nearly four years has resulted in collection of more

than one hundred cases with varying clinical presentation. In all of these, total level along with other hormones and the blood investigations relevant to the system involved was assayed. Seventy three percent of patients had testosterone levels below the normal values. Eighteen percent of patients did not have the testosterone below normal they however had levels along the lower limits of normal values. I think it is significant clinical observation and shows the extent of the problem. The variety of presentations makes it difficult to create a clinical type-set for Andropause and it is usual for physicians to get patients who have symptoms which are different from what they have learnt and practiced.

In spite of the fact that there had been tremendous progress in the medical field during the past few decades but the care of the aged whose last years of life make them suffer from increasing ill health and disability, is neglected by the society, the Government and the medical science particularly in this country. The promotion of healthy aging and prevention of disability in the elderly must assume a central role in medical practice as well as in the planning of national health policy and social welfare programs. The issue is to improve the quality of life of the old persons so as to enable them to remain active, independent and productive.

Physiology of Testosterone

Testosterone, one of the most important androgens, is synthesized from cholesterol. It was first isolated by a Dutch scientist in 1935 from mice testicles and successfully synthesized by the German biologist Adolf Butenandt. Although it was the first hormone to be discovered, yet its overall role is still not completely defined.² Testosterone is primarily produced in the Leydig cells of testes. It is also produced in small quantities in the adrenal glands in both men and women.

The regulation of testosterone in blood is a complex system, through an interrelation between hypothalamus, anterior pituitary and the testes. The regulation of testosterone levels happens through a feedback mechanism. The hypothalamus secretes Gonadotropic Releasing Hormones (GnRH) which further stimulates secretion of Luteinising Hormone (LH) that has a direct effect on the production of testosterone by the Leydig cells in the testes. Another hormone secreted by the anterior pituitary gland is Follicle Stimulating Hormone (FSH) that has got direct effect on spermatogenesis. Both testosterone and FSH act synergistically on some of the testicular cells to stimulate the secretion of Androgen-Binding Protein (ABP). This protein binds to testosterone and keeps the concentration of testosterone high near the area in the testis where the sperms are produced. Testosterone is liquid soluble which diffuses out of the different cells/tissues of the testes into the blood. The testosterone that is secreted by the Leydig cells of the testes also affected by some target cells in the prostate gland where the enzyme 5 alpha-reductase converts testosterone to even more potent androgen called

dehydrotestosterone (DHT).

Both these androgens bind to the same receptors, which are found within the nuclei of target cells. The hormone-receptor complex acts to regulate gene transcription, turning on transcription of some genes and turning off transcription of other genes. As a result of these changes in gene activity, following are some of the effects, amongst many, on the male body.³

1. Testosterone plays a crucial role in the development of the male excretory ducts and the descent of testes in the embryo. Formation of the external genitalia, on the other hand, is influenced by DHT. Testosterone also plays a role in the development of certain regions that typifies a male brain.
2. The development and enlargement of male sex organs and the development of masculine secondary sexual characteristics that are seen during puberty are due to Testosterone and DHT. These include physical changes like wide shoulders and narrow hips; pubic, axillary, facial, and chest hair; thickening of the skin; increased sebaceous (oil) gland secretion; and enlargement of the larynx thereby deepening of the voice.
3. Androgens promote sexual behavior including libido in both males and females and spermatogenesis in males.
4. Androgens stimulate protein synthesis. This obviously brings about heavier muscle and bone mass of most men as compared to women.

Testosterone helps to build protein and is essential for normal sexual behavior and producing erections. It also affects many metabolic activities such as production of blood cells in the bone

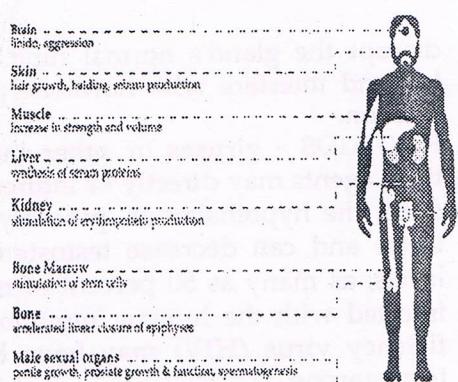


Fig 1: Effect of testosterone on body organs

marrow, bone formation, lipid metabolism, carbohydrate metabolism, liver function and prostate gland growth. Fig.1 summarises the effect of testosterone on different organs of the body in addition to the effect on other systems. It is not essential that in an individual with low testosterone all the target organs are involved, rather this rarely happens.

Testosterone and females

It is a common misconception that testosterone is solely a male hormone. However, testosterone is also present in the blood of females. The central biological difference between adult men and women, then, is not that men have testosterone and women don't. It's that men produce much, more of it than women do. An average woman has 40 to 60 nanograms of testosterone in a deciliter of blood plasma as compared to 300 to 1,000 nanograms per deciliter in men.²

The major female hormone is 'estrogen' which is more concerned with reproduction in the female and is the correlate of testosterone in males.

At the time of conception even the embryo is a female and until and unless this is altered by the testosterone, the

embryo shall develop into a female child.² Therefore, in embryo it is the testosterone that makes the real boy in its form to make the masculine body and brain. In men, there is flood of testosterone twice first at six weeks after conception and then at puberty. The burst of testosterone in embryo primes the brain and the body sensitizing the male features with its instinctual knowledge how to respond to the latter's flood of testosterone when the changes of puberty are brought in the boy. Without testosterone the human would revert to the formation of female. Anybody based on this scientific ground may believe in the statement that it is not women who are made out of men but it is men who are made out of women.

Besides it's control on body and brain, the big T also co-relates with energy i.e. self-confidence & competitiveness having strength and sexual drive. Testosterone is elevated in response to short-term confrontational situations e.g. street-fights, high-level debates and also in response to highly charged sexual environment, pornographic websites. However, in long-term stressful situation like war, testosterone levels decrease. It is higher in working women than housewives. There are many more studies on record that the all lawyers who are habitual to combat have testosterone at higher level than other lawyers. Testosterone levels have also been studied amongst criminals who have higher levels of testosterone than the normal males of same age.

Causes of Male Hypogonadisms

The causes of the deficiency of testosterone in the male body can be innumerable. Some of them are described below:

- The effects of aging on testosterone production - Andropause
- Testes-Based Conditions
- Pituitary/Hypothalamus-Based Conditions
- Genetically-Based Conditions
- Miscellaneous causes

The effects of aging on testosterone production - Andropause

As men age, their ability to produce testosterone declines^{3,4}. Some men's production of LH decreases with aging, which lowers testosterone production. Moreover, a protein called sex hormone binding globulin (SHBG) increases in older men, which reduces the amount of free (unbound) testosterone in the blood that is available to tissues, such as muscles. Aging also causes changes in the daily cycle of testosterone production. For example, younger men show a peak of testosterone in the morning, but this finding is blunted in older men.

Testes-Based Conditions

Men whose testosterone deficiency is caused by an abnormality in the testes often display increased FSH levels, increased LH levels and impaired sperm production. These conditions include:

- Trauma - a direct physical injury to the testes.

Pituitary/Hypothalamus-Based Conditions

Men whose low testosterone levels result from defects in the pituitary or hypothalamus generally have a low or low-normal FSH level and low or low-normal levels of LH. These conditions include:

- Pituitary tumors - the growth of abnormal tissue in the pituitary can

disrupt the gland's normal functioning and interfere with hormone production.

- HIV/AIDS - viruses or other infectious agents may directly or indirectly affect the hypothalamus, pituitary or testes and can decrease testosterone levels; as many as 50 percent of men infected with the human immunodeficiency virus (HIV) may have low testosterone.

Genetically-Based Conditions⁵

Men may have low testosterone as a result of chromosomal abnormalities or genetically-based conditions. These conditions include:

- Klinefelter syndrome - a genetic condition in which an extra X chromosome is present (about one in every 400 men have this); testosterone production is low to low normal; men with this syndrome also may have markedly reduced bone density.
- Kallmann syndrome - usually a recessive genetic disorder associated with the X chromosome, which occurs in about one of every 10,000 men. A deficiency of GnRH impairs the release of LH and FSH, which decreases testosterone production; men with the syndrome lack the sense of smell; testes do not enlarge at puberty.
- Prader-Willi syndrome - a genetic disorder characterized by decreased muscle tone in infancy that improves with age, underdeveloped genitals (including undescended testes) and low sex hormone levels. An obsession with food and compulsive eating, may begin before the age of six.
- Myotonic dystrophy - the most common adult form of muscular dystro-

phy, this genetic condition only occurs in men and is carried on the Y chromosome; because testicular failure usually occurs around the age of 30 to 40, men may have sons at risk for the disease.

Miscellaneous Causes

- Generalized vascular diseases such as diabetes and perhaps even problems caused by heavy smoking.
- Diseases, where the immune system attacks and destroys the testes such as variations of Systemic Lupus Erythematosus
- Viral infections such as mumps.
- Stress, excessive alcohol, overweight and lack of exercise add to the general effect of ageing.⁶

Environment⁷

Xeno-estrogens, which are primarily petrochemical, have a very potent estrogen-like activity. They are in our air, fuels, pesticides, herbicides, fungicides, plastics, clothing, bug / mosquito sprays and personal care products. Such synthetic hormones have molecular structures that are not compatible with our physiology. We do not have enzymes designed to modify their effects, nor can they be efficiently excreted. Therefore, these synthetics can have an unnatural and far more potent hormonal effect on our body systems than natural hormones.

Our diet is also contaminated with hormones. Synthetic estrogens are used now-a-days to fatten cattle, as well as other meat-producing animals, and to increase milk and egg production. These are innocently ingested by us through our meals.

All these synthetic estrogens cause Estrogen Dominance where the level of

Testosterone is already compromised and causes precipitation of the Andropause symptoms.

Surgical Causes

Surgical removal of or surgical injury to the testis and male reproductive tract (including hernia repairs, prostatectomy etc).

Vasectomy however needs special reference. Vasectomy seemingly a simple operation, is often presented as the ideal and infallible solution to family planning. No sperm - No problems. It is widely thought that since the blood vessels are not cut and testosterone levels in the blood remains normal, vasectomy will not have any effect on sexual desire and performance. Unfortunately, it is not quite that simple. The testicles are very delicate and sensitive structures. They are very complex organs, with a rich nerve, blood and lymphatic supply. Also they are under intricate hormonal and temperature control to regulate sperm and testosterone production. So that the man doesn't produce antibodies to his own sperm, which to the rest of the body is foreign protein, there are important defences keeping the sperm isolated from the immune system. All these systems can be disrupted, even when the vasectomy seems to have gone smoothly, and there can be an alarming variety of short- and long-term complications, which can sometimes be serious.⁴

Long Term Complications of Vasectomy: Vasectomy reduces testosterone production thereby contributing directly to the onset of andropause. It is believed that the incidence and prevalence rates of andropause in patients with vasectomy is twice as high as that in the general popu-

lation. A global survey conducted on the internet 35% people with andropause admitted having had vasectomy. This rate was 45% in Australia alone. However the mechanism of this reduced hormonal production is not clear. The most likely cause seems to be an auto-immunity to sperm released into the tissues after the vasectomy^{8,9,10}. More research is needed to prove how this happens and how it can be treated. Reversing the vasectomy does not seem a good idea, as the damage is done early on, and attempts at reconstructing the vas may only stir up further trouble, more pain or more antibodies.

Effects of Testosterone on Metabolism

By virtue of its influence on gene transcription, the primary role of testosterone is in protein metabolism. However, it also regulates sugar metabolism and through this pathway it influences the fat metabolism as well.¹¹

Protein metabolism

The anabolic action of androgens upon the skeletal muscle is well known for many years that have promoted its misuse in not only body builders and wrestlers, but also other sportspersons.^{12, 13}

Some authors through experimental studies have proven the effects of androgens on the assimilation of amino acids like leucine into muscle proteins. Incorporation of uridine into ribonucleic acid of muscle has also been shown to increase under the influence of testosterone.

Carbohydrate metabolism¹¹

The decrease of male hormone with age leads to chronic intolerance to glucose and sometimes, diabetes. An intramuscular

injection of 5 to 25 milligrams of testosterone propionate provokes a significant decrease of glycaemia within two or three hours following the injection and its action lasts four or five hours. The reduction of glycaemia is about 1 gram per litre with diabetics and glucosuria is reduced. After androgen administration, the glycaemia of diabetics is reduced during a few days and rises afterwards to the initial levels.

Fat metabolism¹¹

Through the pathway of sugar metabolism testosterone influences the fat metabolism. When there is hyperglycemia, it can't be burned enough through the Krebs' cycle and you have an overproduction of acetyl-coenzyme A which is the initial compound for making cholesterol and lipids.

Because every man, some time or other, will have a lack of testosterone production after forty, the values for triglycerides and of cholesterol will increase in the blood with age.

Effects of Testosterone on Heart, Blood and Blood Vessels

Generally you are as young as your heart and brain. This all is based on how good is circulation to these vital organs of the body.

Involvement of blood vessels¹¹

As age advances, arteriosclerosis and atherosclerosis sets in different vessels all over the body. The muscle fibres are replaced by collagen tissue/fibrous tissue making the arteries inelastic. Now strong evidence is coming forward that muscular fibres of the arteries need testoster-

one to maintain their activity. Therefore deficiency of testosterone may accelerate arteriosclerosis. The pathology of atherosclerosis is characterized by fat and cholesterol deposition in the arterial wall. This phenomenon is the consequence of cholesterol and lipid accumulation in the body through the impaired sugar and fat metabolism when testosterone is low in the body.

Therefore arteriosclerosis and atherosclerosis are two general involution phenomena increasing with the decrease of testosterone secretion.

Ischaemic Heart Disease

For the last nearly 50 years, most of the doctors including the Cardiologists are of the view that testosterone is bad for the heart which is based on two reasons, one reason is that heart-attack in men under their 50s is five times more common than in women in most of the western countries. According to this line of reasoning, therefore, Testosterone is bad for the circulation. The second reason that Testosterone is bad for heart is because of the bad affects of the methyl testosterone orally and its use by athletes taking the wrong drug in wrong doses for the wrong reason and all this gives bad propaganda in the papers.¹⁴

Recent researches, however, beg to differ. Good numbers of papers are now available suggesting that individuals with low testosterone have higher incidence of developing heart disease. These observations on deficiency of testosterone and its effect on heart and coronary vessels and usefulness of testosterone is further authenticated by various workers.¹⁵⁻¹⁷

Georges Debled has quoted similar studies and showed a positive correla-

tion between lower Testosterone levels and coronary heart diseases. However, he points out, elevated estradiol levels pose greater risk for developing CHD; Table 1.¹¹

Table 1: Association of testosterone levels with CHD

Hormone	Plasma level	Correlation with coronary heart disease
Total Testosterone	Low	+
Free Testosterone	Low	+
DihydroTestosterone	Low	+
Estradiol	Elevated	+

That Testosterone has beneficial effect on the heart can be discerned from its vasodilatory effect on blood vessels thereby increasing the much required blood supply and nutrition to the muscles of the heart.^{14,18,19} It has also been found that Testosterone can prevent the type of spasm of coronary arteries that causes angina.

High cholesterol levels (with the exception of HDL-cholesterol) are disadvantageous for the heart as the risk of developing CHD is greater in such individuals and which is all the more evident from Georges Debled's work¹¹, Table 2.

Table 2: Correlation of Cholesterol levels and CHD

High level of	Correlation with coronary heart disease
Total cholesterol	+
LDL - Cholesterol	+
Triglycerides	+

Testosterone has anti-atherogenic properties. This is by virtue of its influence on the fat metabolism whereby it causes reduction in cholesterol and body fat in general.

Blood Hypercoagulability

In patients with coronary artery disease

and particularly those patients having blockade of the coronary vessels the blood is hypercoagulable. Keeping in view of this analogy, all such patients are prescribed aspirin. The main question about blood is not how it coagulates but keeping it fluid. The dissolution of the blood clot is under the influence of fibrinolytic agents and such fibrinolytic agents of the blood are under the influence of testosterone.²⁰

Anaemia

The number of red blood cells decreases by 10% in castrated men. This is similar in men with low testosterone levels in blood. The ischaemic heart disease is of course aggravated by this phenomenon.

The erythropoietic function of the kidneys is partially under the control of Testosterone. Lack of testosterone therefore, can produce anaemia.

In 1981, Nagean Y et al. reported in the American Journal of Medicine the improvement of anaemia in a serial of 137 patients when treated by male hormones. Anaemia recurs when the therapy is stopped and improves again with androgens.²¹ The family physician may think of low Testosterone as cause of unexplained anaemia in old age.

Varix, Hemorrhoids and Thrombosis

The veins and the arteries are constituted by muscle fibres. The strength and tone of these muscle fibres is maintained by Testosterone. Lack of Testosterone produces involution of the muscular tissue of the vessels. Such situation in veins and arteries can cause varix, haemorrhoids and even thrombosis that have their own complications subsequent to dislodgement of the thrombus to vital organs like brain.¹¹

Effects of Testosterone on Mind and Matter

What men do and how they do things depends on an intricate relationship between testosterone, mind and matter. This cannot be better explained than Andrew Sullivan's excellent article, which was published 7 years ago. His observations are as true today as they were when he wrote the article.

Andrew Sullivan, who himself is HIV positive noted extreme fatigue and weight loss. He noticed that his body was producing far less testosterone than it should have been at his age. Therefore he used to give himself the injections of testosterone and experienced the true effects of testosterone himself.²

He mentioned in his monograph that Men and women differ biologically mainly because men produce 10 to 20 times as much testosterone as most women do, and this chemical, profoundly affects physique, behaviour, mood and self-understanding. As more people use testosterone medically, as more use testosterone-based steroids in sports and recreation and as more research explores the behavioural effects of this chemical, the clearer the power of that biology is. It affects every aspect of our society, from high divorce rates and adolescent male violence to the exploding cults of bodybuilding and professional wrestling. It helps explain, perhaps better than any other single factor, why inequalities between men and women remain so frustratingly resilient in public and private life.

The effects of injection testosterone were that his weight increased from around 165 pounds to 185 pounds. His collar size went from 15 to 17 1/2 in a few months. His chest went from 40 to 44. His appetite improved. Going from napping

two hours a day, he rarely slept in the daytime and had enough energy for daily workouts and a hefty work schedule. He could squat more than 400 pounds. Depression, once a regular feature of his life, was now a distant memory.

Within hours following injection testosterone he felt a deep surge of energy. His attention span shortened with in two or three days after the shot, he found it harder to concentrate on writing and felt the need to exercise more. His wits were quicker, the mind faster, but the judgment was more impulsive. It is not unlike the kind of rush he got before talking in front of a large audience, or going on a first date, or getting on an airplane, but it suffused him in a less abrupt and more consistent way.

Mental abilities

Testosterone affects verbal ability and mental focus. The female style of thinking has been described as "web thinking" and the male style "step thinking". And it's mostly due to testosterone's effect on the brain.²²

The physical effects of testosterone are well documented but the awareness of its profound effects on the psyche is limited. Since it is unethical to experiment with human embryos by altering hormonal balances, what we do know today of the testosterone impact on mind is based on research conducted on animals, personal experiences and/or surveys. There are subtle differences in individual interpretation of testosterone effects on mind however, majority agree upon the notion that testosterone endows the individual with energy, self-confidence, competitiveness, tenacity, strength and sexual drive. This is irrespective of caste, creed and even gender.

Yes, women are also affected by testosterone similar to men. The animal experiments have shown that the genetic make-up does not affect this effect. Typical "male" behaviour, in other words, corresponds to testosterone levels, whether exhibited by chromosomal males or females.

Although libido is not entirely testosterone endowed, individuals with low testosterone levels exhibit lesser sexual arousal and activity. Around the age of 25-30 years, when the testosterone levels are highest, men are prone to promiscuity.

It won't be altogether incorrect to say that testosterone is a "Booster" hormone. It not only boosts the musculo-skeletal system presenting with enhanced muscle bulk, strength, power and stamina but also it has anti-depressant properties. A recent Australian study on men with suicidal tendency shows that about 30% of such men had low testosterone levels. When these individuals were managed with Testosterone, their views about life were radically altered, from extreme pessimism to optimism. This has given firmness to belief as mentioned by TASA coordinator, Linda Byart- "Suicide in older men is often hormonally based and can be prevented by appropriate hormone replacement therapy" and the same is supported by Alison Mc Cook who has found that men suffering from Andropause are four times likely to suffer depression than other males with normal Testosterone levels.^{23, 24}

Women have a greater incidence and prevalence of depression than men. How this happens is not known exactly, but it has been hypothesised that testosterone increases the physical activeness, thereby

allowing lesser time for retrospection. The concentration level also increases with testosterone making it more lucrative for use (and misuse for that matter). The attention span improves and the "reflex time" for both mental and physical functions reduce, making the individual sharp.

The energy and vigour that testosterone awards, brings about restlessness in individuals. Although they may be able to accomplish more in shorter time-span, individuals with high testosterone levels are more likely to get flustered with delays/ failures.

Irritable Male Syndrome (IMS) with its various symptoms of irrational anger, depression and loss of control is triggered by a sudden drop in levels of testosterone.²⁵ Introduction of testosterone results in mood stabilization, the person becoming easier to be around, more able to socially relate to others and many other positive characteristics.^[26] Stresses such as bereavement, divorce or life-threatening illnesses lowers testosterone levels. Based on this assumption psychiatrists do use testosterone therapy for the patients under depression.

Sleep disorders

The andropausal male may experience sleep disorders like insomnia. The affected individual may have interrupted sleep or less sleep.

Psychological Challenges

Some psychological aspects have been dealt with in the preceding pages, however the views of Robert S Tan on the role that testosterone plays on our psychology needs attention. The male in his life faces several psychological challenges and these are often amplified during

andropause²⁷

1. His sexuality
2. His emotions
3. His mind
4. His courage
5. His productivity
6. His personality
7. His character
8. His boyish behavior

The sexuality of a youthful man aged between 15 to 30 years when his testosterone was at an all time high, drops to the ebb during the andropause. Young men often have testosterone levels exceeding 1000ng/dl. Compare this with 80 year-old men, whose average testosterone is 200ng/dl. You might say the sexuality of a man in the andropause is down 80%, a seemingly disastrous event.

The older men tend to be closer to their family and are more interested in domestic issues than when they were younger. It is as if the lack of testosterone makes them more "feminine". They take on more homely roles of cooking, cleaning and looking after children. More often than not, they devote much more time and attention to their grandchildren than they had previously to their own children when they were parents themselves. Perhaps it is because they have more time during the andropausal years as they have probably retired by then. Their emotions become less "fiery" and take on a gentler aspect, so in a sense, the decline of testosterone enhances domestication skills.

In the andropausal years the mind becomes less sharp and nimble. The older male becomes less swift in mental calculations and his judgment is not as accurate as before. Perhaps he used to make razor-sharp business deals, but now he makes blatant mistakes and incurs painful finan-

cial losses. It is often attributed to aging, but it may be partly due to the decline of testosterone. In more severe cases, the memory may get impaired, leading to dementia. It is not uncommon for older individuals to report misplacing a key or forgotten important details. Often the memory loss is so minor that it does not affect everyday functioning. This memory loss has sometimes been referred to as "age related memory loss" and is not as severe as Alzheimer's disease. Demented hypogonadic men who had low testosterone were administered testosterone and improvements in their visual-spatial cognitive abilities were demonstrated. However, more research is needed before recommending testosterone as a possible treatment of certain dementia.

Alzheimer's Disease

Alzheimer's disease is a chronic, incurable, and unstoppable Central Nervous System disorder that occurs gradually, resulting in memory loss, unusual behaviour, personality changes, and a decline in thinking abilities. These losses are related to the death of specific types of brain cells and the breakdown of connections between them.

Alzheimer's disease is characterized by the age-related deposition of β -amyloid (A β) 40/42 peptide aggregates in vulnerable brain regions. Testosterone reduces neuronal secretion of Alzheimer's β -amyloid peptides. Testosterone supplementation, therefore, in elderly men may be protective in the treatment of AD.^{28,29}

Effects of Testosterone on Muscles, Bones, Joints and Nerves

Some of the patients of andropause complain about paraesthesia of the distal parts

in both hands and the feet, which invariably happens in the early hours of morning. Besides testosterone some of these patients required injections of vitamin B12.

Testosterone is an anabolic hormone that helps in building muscles, bones and connective tissues.

A deficiency in Testosterone reverses these positive effects and brings about weakness in muscles, bones and connective tissues. With ageing connective tissue loses its elasticity and its constitution is changed for worse. "Middle age man becomes stiff".

Effect on Posture

The onset of andropause brings about progressive rounding of the shoulders and loss of height. Simultaneous reduction in bone density may lead to vertebral collapse and kyphosis.

Altered posture also affects the overall alignment of the structures in and around the spine. Back pain is a frequent complaint amongst people with low testosterone levels.

Another important aspect of andropause is the abdominal enlargement, particularly when the muscles of the rest of the body are wasted en masse. This is due to excessive fat deposition in and around the abdomen that is added on to the already weak emaciated muscles of the abdomen.

Effect on Muscles.

Most of the andropause patients present with mild to severe pain in muscles that is not relieved by rest. Such pains may be reduced temporarily by using pain-killing drugs but such measures are severely limited in their efficacy and utility. The muscles also lose

their normal conformation because of wasting; most apparent in the thighs and calves. These muscles become weak losing their strength, power and endurance. Many people would have experienced a gradual slowing down of their walking speed and loss of distance one can travel which they would have attributed to ageing. They would also have experienced difficulty in climbing stairs, getting up from low seats or have a feeling of instability in legs while walking. This however, could be because of lowered testosterone level that is normally not appreciated as a causative factor. Overall, the muscles not only have a reduced working capacity, but also their "reaction time" to contraction increases thus causing slowed movements than these individuals would have normally had.

It is an important to note that group of muscles all over the body are tender. The muscle tone in andropause men also goes down resulting in flabbiness. The patients commonly complain of cramps of variable intensity especially in the lower leg and feet. The cramps occur particularly when used suddenly against resistance.

It is not only the muscles of the limbs are affected. The muscles all over the body are affected so much so that affection of the levator ani and the other pelvic muscles may be the cause of constipation.

Effect on Tendons

The tendons lose their elasticity and stretchability. This is particularly felt on Tendo-achilles. On walking for a short distance the tendons of the lower limbs become painful. If cases of tendon ruptures in old people are investigated lack of testosterone may be one of the important causes.

Effect on Ligaments

In andropause ligaments lose their elasticity. Therefore it may be one of the causes of stiffness of the joints. In foot, small bones join together through ligaments. Since the ligaments become stiff the burden is on the bones to bear the strain on walking. This whole process makes the feet painful on walking a short distance.

Effect on Joints

Early - The andropause male usually has morning stiffness of various joints particularly that are used for weight bearing or carrying loads specially the knee joints. At this stage usually, there is no limitation of movements of these joints. The pain in the neck and back is due to multiple factors namely, osteoporosis, receding muscle support and changes in posture.

Late - If andropause remains undiagnosed and untreated, the resultant effect is on the joints wherein the joint cartilages are subjected to abnormal shearing forces. With concomitant alteration in the basic composition of the joint cartilage, the resultant effect is Osteo-arthritis of various joints particularly knee joints. Testosterone also potentiates the immune system of the body thereby reducing the risks of developing auto-immune disorders like Rheumatoid Arthritis of old age and other autoimmune diseases that may affect the joints.

Effect on Bones

In a healthy individual, bone tissue is constantly being broken down and rebuilt. In men, testosterone is thought to play a role in helping to maintain this balance. In an individual with osteoporosis, more bone tissue is lost than is regenerated and it is estimated that between

the ages of 40 and 70 years, male bone density falls by up to 15 percent. Wrists, hips, spine and ribs are most commonly affected. Due to this, the individual may have severe pain in the bones adjoining the joints or anywhere including generalized tenderness of some bones or the other.

Osteoporosis and its ramifications are clearly mentioned in women after menopause. Unfortunately, with advancing age and declining testosterone levels, men, like women, seem to demonstrate a similar pattern of risk for osteoporosis. What's more, approximately one in eight men over the age of 50 years suffer from osteoporosis.

The incidence of hip fractures rises exponentially in ageing men, as it does in women, starting about 5 to 10 years later. These need special attention (especially fracture of the neck of femur) in the form of regular assessment of testosterone levels. Particularly, up to one third of hip fracture patients never seem to regain full mobility and close to 40% male patients with hip fracture patients die within one year. Administration of Testosterone with usual fracture management is likely to decrease the morbidity and mortality, thereby adding on to a comfortable old age.

Effect of Testosterone on Sex and Sex Organs

Being an Orthopaedic Surgeon my experience is limited on this score. The observations are based on the history of 100 personal cases and other doctor colleagues.

Sex

Testosterone secretion decreases with ageing. This effect leads to sexual invo-

lution in men, characterized by weak libido, weak penile erection, poor frequency of sexual intercourse, impotency, ejaculation problems, phimosis leading to painful intercourse, sclerosis of penis and sometimes gynaecomastia.

The Penis & Erectile Deficiency

Testosterone plays a major role in the development of secondary sexual characters including the development of the size of the penis. Testosterone is the hormone of 'Performance' as it excites desire, causes a strong erection to perform the sexual intercourse successfully and satisfactorily, provides lubrication prior to ejaculation, causes ejaculation and is responsible for orgasm.

Dwindling testosterone levels take away the libido and performance. Due to lack of Testosterone the penis is deficient in erection. It may have weaker erections or may not erect at all.

Loss of libido is the earliest sign of andropause and if low level of testosterone continues for long time it affects the erection and the size. Because of these reasons some of the patients of andropause may not have erectile deficiency though they may have loss of libido.

The sexual problems and the level of testosterone in 4 cases have been described in table 3.

Prostate³⁰

Testosterone works directly on many tissues of the body. But, Dehydrotestosterone (DHT), a hormone derived from testosterone, is much more potent than testosterone and acts on prostate gland and the other sexual organs. Without DHT a

male would not develop his external sexual organs or his prostate.

Table 3: Sexual Problems and the testosterone

Age	Symptoms	Total T Level	Free T Level
54	1. Inadequate erection 1-2 years	2.97 ngm/ml (1.95-11.50)	3.0 pg/ml (5.5-42.0)
	2. Unsatisfied sex because of premature ejaculation		
43	1. Loss of erection		
	2. decrease in timing and duration of sexual intercourse and weakness	2.32 ngm/ml (1.95-11.50)	1.70 pg/ml (5.5-42.0)
34	1. Tiredness and general bodyache		
	2. Lack of interest in work at shop	3.50 ng/ml	7.0 pg/ml
	3. Early discharge and low erection		
26	1. Loss of erection		
	2. Low interest in sex	2.4 ng/ml	---
	3. Poor sex performance		

Dr. George Debled who specializes in sexual dysfunction and prostate problems has an experience of treating approximately 2,000 patients since 1970. He orders a battery of blood tests, which he calls a male hormonal profile and concluded that young men with impotency or libido problems often have hormone profiles similar to older men with similar problems and BPH. Testosterone and especially free testosterone levels are reduced and other hormones, such as estrogen and prolactin are increased.

Dr. Debled points out that testosterone is necessary to nourish all of the tissues of the male urinary and reproductive systems, including the prostate. It nurtures the development of muscles and is necessary for proper muscular functioning. When the muscles of the bladder and

the prostate do not receive sufficient testosterone, they tend to function poorly, atrophy and fibrose. This may then help to explain some of the symptoms of BPH. Rather than trying to inhibit the formation of DHT, testosterone is administered to all these patients. Having successfully treated over 2,000 patients with impotency and prostate problems over the past 15 years, he believes that he can forestall BPH surgical procedures for at least 10 years by giving men the testosterone. He has also noticed that his patients have a much lower incidence of prostate cancer than would be expected, suggesting that testosterone rather than causing cancer may actually be a preventive.

General Body Effects of Testosterone

Universality of the androgen receptor

The androgen receptor is identified in a variety of organs: the seminal vesicles, the hair follicle, the sebaceous glands, the foreskin glands and more generally all secondary sexual organs, the testicles and the epididymis, the uterus and the ovary, the kidney, the submaxillary glands, definite cerebral areas as the hypothalamus, the pituitary gland and the cerebral cortex, the levator ani muscle and the skeletal muscle, and the bone marrow. In reality small quantities of androgens' receptors have been observed in numerous organs.

In andropause overall the health goes down. The stamina for work goes down. One loses interest in the work. The agility is reduced.

Andropausic gait

The elasticity and the stretchability of the both muscles and tendons is reduced.

When this is coupled with the weak muscles of calf, thigh and the foot muscles, the normal springiness of the gait is lost. One would be walking on a wider base in a slow and painful pace. The pain is felt earlier on the tendons than the muscles, particularly the Achillis tendon (not normal gait of heel strike, foot flat and toe off).

Hair

The growth of hair is reduced, the hair become thinner and grey. An andropausal individual may complain that he goes to the barber less often than earlier. Similarly it be noticed that he may not feel the necessity of shaving the beard daily and regularly. The hair on the rest of the body is also reduced.

Skin

The skin all over the body becomes dry. The thickness of the skin also reduces. It reduces its elasticity and the shine. The skin rather looks darker. Since it loses its elasticity and proper thickness it starts getting wrinkled all over the body but this is more evident on the face.

There are more chances of getting skin infections because the usual protection of the connective tissue to the skin is dampened. The loss of skin elasticity also takes its toll on the skin covering the glans of the penis leading to phimosis.

Due to the combined effect of the amyotrophy of the muscles and loosening of the skin, different facial crease of the forehead and the face become prominent. The cheeks also pucker in.

Obesity (Table 4)

Obesity follows fat accumulation. It has

been seen that obese men have lower testosterone levels in the blood, which is directly related to the degree of obesity.^{11,31}

Table 4: Low plasma testosterone in massively obese men

Obese group (200 - 280 % of ideal body weight)	223 ngm/100 ml testosterone level
Control group (85-135%v of 599 ngm/100 ml ideal body weight)	testosterone level

Because the testosterone secretion decreases with age it seems logical to believe that this phenomenon is a leading cause of fat deposits everywhere in the body and that being overweight is a clinical sign of andropause.

Lungs

Normal breathing is a result of good elasticity of connective tissue of the lungs. Respiratory muscles in good condition are also necessary for a good respiration. Connective tissue deterioration and amyotrophy of the respiratory muscles in andropause leads to breathing problems.¹¹

It is a common observation that some men become breathless after climbing some flight of stairs or walking even short distances. It has been my observation that andropause is the main reason behind this. In some of the cases after TRT their have been improvement on this score which of course needs confirmation through respiratory function tests.

Immunity

Testosterone stimulates immunity. A decrease of androgens' secretion induces a lack of production of lymphocytes leading to chronic infections and cancer. Testosterone therapy may gains importance in cases of HIV positive patients.²

Another role of testosterone is to help regulate the immune system. Patients with autoimmune disorders, such as rheumatoid arthritis, systemic lupus erythematosus and multiple sclerosis appear to benefit from testosterone. It has been used to improve appetite, increase weight in malnourished patients, improve wound healing and increase resistance to infection.³⁰

Eyes

I have observed that in Andropause the acuity of vision is disturbed particularly the peripheral vision. Moreover it has also been observed that lack of testosterone causes dryness and itching in the eyes as if the secretion of lacrimal glands is reduced. This issue needs further investigations before being authenticated.

George W. Drach pointed out that fundoscopic examination of the retina of the eye may have bearing in diagnosing the cases of Erectile Deficiency (ED), which may be related to generalized atherosclerosis which afflicts the penile vessels as well.³²

Clinical Presentation

The role of testosterone on different organs of the body and on metabolism are convincing that if there is deficiency of the male hormone in the body, certain systems are likely to be affected and depending upon the involvement of organs the patient may present with a mixed clinical picture thereby leading to a combination of symptoms of different diseases. I have seen in my Orthopedic practice that old patients presenting with the symptoms related to bone and joints often suffer from osteoporosis. On taking their detailed medical history it would be evident that these patients suffer from

some other disease invariably like diabetes, affection of the cardiovascular system, kidney disease or symptoms of thrombo-embolic phenomenon. Further, most of these patients have loss of libido and/or Erectile dysfunction. It is not uncommon in such patients to have some other generalised effect on the rest of the body or on brain. Table 5 mentions in short about the involvement of different systems in the body.

Table 5: Symptoms Associated With "Andropause"

General

1. Reduced general well being
2. Impaired cognitive function
3. Skin alterations
4. Decrease in body hair
5. Thinning of body hair
6. Sleep Disturbances
7. Slower recovery to injury
8. Reading Difficulty (small print)
9. Reduced interest in Sex
10. Weight gain
11. Abdominal obesity
12. Reduced haemopoiesis
13. Reduced immunity
14. Cancers

Sexual

1. Reduced libido
2. Erectile Dysfunction
3. Prostate enlargement

Bones and Muscles

1. ✓ Muscle weakness
2. ✓ Muscle soreness and Stiffness
3. ✓ Muscle tenderness
4. ✓ Reduced muscle mass and strength
5. Osteoporosis / Reduced Bone Mass
6. Fatigue (less endurance for physical activity)
7. Osteoarthritis

Diagnosis

Generally, a blood test needs to be run in order to diagnose andropause. After the age of 50, the average testosterone level decreases at a rate of approximately 1% per year³⁵. However, if only absolute

testosterone levels are evaluated, many patients with Andropause will be missed. There may be an increased level of sex hormone-binding globulin that binds the testosterone and makes less of it available to the tissues. Also, as men get older, there is less of a daily rhythm to the secretion of the testosterone. Younger men have higher testosterone in the morning, which then decrease as the day wears on. In older men, this curve is flattened, leading to steady low levels of testosterone throughout a 24-hour period. Here are some issues regarding testosterone that are important to remember:

- 1) It is not yet known what level of serum testosterone defines a deficiency in older men. Generally it is accepted that two standard deviations below the normal values for young men is considered abnormal.
- 2) A man may have large variations in his serum testosterone levels over time. He may have normal testosterone levels one day and have decreased testosterone levels the next, so it is important to look at hormone levels over a period of time.
- 3) In older men, affected organs may respond differently to androgens.

Not all men will need the same level of testosterone to maintain proper function of their brain, bone, prostate or muscle cells etc. Therefore it would be incorrect to say that there is one standard level of testosterone that should be achieved by all men.

There remains significant controversy as to how best to measure testosterone levels and diagnose andropause. It is well accepted that if total testosterone is less than 200 ng/dL, a man will be considered as having a low testosterone level. If his total testosterone is greater than

600 ng/dL, low testosterone may be ruled out.

At this point in time, it appears that the best measurement of androgen status is either "free testosterone" or "bioavailable testosterone." These measurements may only be available through specialty laboratories. These can be measured in different ways. Usually I get the serum testosterone evaluated from one laboratory if possible. In this laboratory serum testosterone assay is performed on enhanced chemiluminescence system (Immulite). The normal laboratory values which I have taken in consideration in my studies are as per it. It is important to mention about my experience on laboratory values of testosterone. Out of 73 patients having diagnosed as andropause on the basis of investigations, only 21 patients had lower values of total testosterone and the rest of the patients had lower values only of the free testosterone. It is therefore important to rely on free testosterone levels.

Treatment

It is established that andropause is due to deficiency of free Testosterone. There-

fore, the obvious treatment would be to replace testosterone to the afflicted individuals.

Before replacing testosterone, a total hormonal assay of these individuals is essential. This is not only to exclude other serious diseases causing hypogonadism such as pituitary tumors, but also to provide the baseline value of different hormones that may also change after giving testosterone. Moreover the dosage of testosterone would depend upon the baseline level of testosterone. Both to establish the diagnosis and to monitor the treatment properly, laboratory measurements of the sex hormones and the complex range of factors regulating their action, together with tests of blood, fat, liver, kidney, and prostate function and hematology profile, all need to be checked before treatment and at each follow-up assessment.

The role of treatment actually is that rest of the endocrine system should be balanced. This may involve the administration of thyroid hormone, DHEA or physiologic doses of cortisol. Some recent studies on ageing indicate that the administration of optimal doses of human Growth Hormone (hGH) may also be extremely useful when it is deficient. Andropause is largely a preventable and treatable condition.

Besides the medicines per se a comprehensive approach that emphasizes lifestyle, including an optimal diet, nutritional supplements, exercise, stress management, reduction of smoking and alcohol, detoxification procedures and energy balancing is more important. Recently anti-oxidants have outweighed all other treatments claiming that even the serious diseases can be controlled with anti-oxidants alone.³⁰

Testosterone Replacement has been shown to be very effective in improving the physiological and psychological functions of the individual, as enumerated below.³⁶

- Improvement in mood and sense of well-being
- Increased mental and physical energy
- Decreased anger, irritability, sadness, tiredness, nervousness
- Improved quality of sleep
- Improved libido & sexual performance
- An increase in lean body mass, a decline in fat mass
- An increase in muscle strength (hand grip, upper and lower extremities)
- Potentially, a decrease in the risk of heart disease

With testosterone therapy, one's attitude improves, reinforcing self-esteem and self-confidence at work, as well as an increased energy at home and in social activities. Most men will feel more vigorous, experience improved energy levels, mood, concentration, cognition, libido, sexual performance and an overall sense of well-being. These effects are usually noted within 3 to 6 weeks.

Other potential benefits include maintenance or improvement in bone density, improved body composition, muscle mass and muscle strength, as well as improvement in visual-spatial skills.

I. Testosterone Replacement

1. **Pills:** Methyl testosterone (Android, Virilon, Testred, Oreton) 10mg, 25mg (not recommended) Testosterone undecanoate (Restandol, Andriol Twsto-caps) 40mg, essentially a testosterone in oil preparation. Mesterolone (Proviron) 25mg - less potent. I have experience of only using Testosterone undecanoate. I recommend that this may be used for TRT.

2. Transdermal Preparations (Testoderm, Testoderm TTS, Androderm): In transdermal testosterone, the hormone is released slowly through the skin to deliver a constant level in the blood, again not a routine pattern, but convenient. Transdermal testosterone can be applied either to the scrotal area or to other areas.

3. Injections

The following forms of injectable testosterone are available.

1. Testosterone Cypionate 100 mg/ml
2. Testosterone Propionate in oil 100 mg/ml
3. Testosterone Enanthanate 200mg/ml
The usual dose is 1cc injected weekly to monthly. This route of administration eliminates the risk of liver damage which may be caused by methyl testosterone as well as eliminating the theoretical risk of changes in cholesterol caused by oral medications. The problem is fluctuating hormone levels and the discomfort of administration.
4. Testosterone undecanoate (Nebido) 1 gm in 4ml. It is available in Europe. Usually one injection is sufficient for 12 weeks.

4. Sub dermal Pellets

These pellets dissolve slowly over a period of approximately three to four months. This provides a normal and very stable serum testosterone level. This prescription causes less lowering of HDL cholesterol, as this does not pass through the liver.

The implant procedure consists of a small incision through which a trocar and cannula are inserted. The pellets are inserted through the cannula, and then the cannula is withdrawn. The incision is then closed with a Steri-Strip, and pressure is applied until bleeding stops, and the area is then covered with a dressing

The requirement for the use of subdermal pellets include

- Good General Health
- No evidence for heart disease
- Normal Cholesterol levels
- Normal PSA levels
- Normal prostate examination, no history of prostate disease

Side effects of Testosterone Replacement Therapy:

TRT can have undesirable side effects that include nausea, vomiting, jaundice, ankle swelling and frequent or persistent erections. Breast enlargement can also develop as testosterone can be converted to estrogen via the enzyme aromatase. More serious complications include water retention, liver toxicity, cardiovascular disease, sleep apnea, and prostate enlargement. These risks are relatively uncommon when the dosage is closely monitored to that found physiologically in the body.

TRT is contraindicated in men with carcinoma of the breast or known or suspected carcinoma of the prostate. A digital rectal examination and laboratory test for prostate specific antigen (PSA) should be checked before initiation of therapy and every 3 to 6 months thereafter.

TRT also should not be considered in those with known hypersensitivity to the preparation or in patients with compromised cardiac, renal, or hepatic functions.

While there is no direct evidence that link testosterone replacement to accelerated prostate enlargement, there is a correlation between testosterone treated hypogonadal men and normal men with prostate volume and age.

Results of TRT may not be evident for several weeks. Impotence may not be corrected after several months of therapy de-

spite improvement in other andropause symptoms. For these patients, evaluation for causes of erectile dysfunction other than hypogonadism due to andropause is indicated.

II. Alternative approaches

1. Phosphodiesterase 5 Inhibitors - Viagra

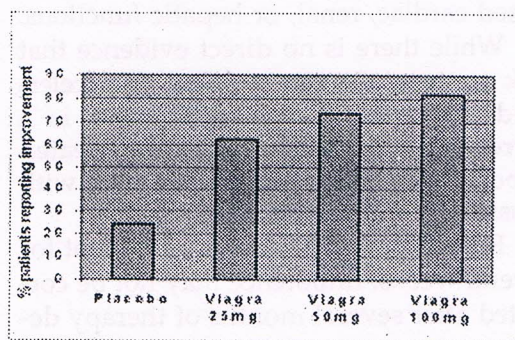
In most men suffering from andropause, low sexual performance or Erectile Dysfunction is the chief concern.

Viagra is one drug that has gained tremendous popularity in this field. Although a recent entrant into the field, it has already benefited more than 16 million men globally. With an efficacy rate as high as 80% as propagated by the manufacturer, it has been shown to work in Erectile Deficiency irrespective of the cause and frequency of the problem and age of the patient.³³

At a study, done on 1448 patients, shows almost 100 mg of Viagra is required to achieve 80% success rate, Chart 1.³⁴

Although both Testosterone and Viagra are treating Erectile Deficiency, their mechanisms of working are radically different. Viagra solely operates by increasing the blood flow to the penis thereby causing stronger erections that may be longer lasting than usual. Test-

Chart 1: Improvement in Erections with Viagra
(Results in 1448 patients)



osterone on the other hand is the hormone of desire in men, the lack of it causing loss of libido. The desire and sexual excitement that Testosterone generates, promotes the production of nitric oxide and thereby the genital blood flow. Thus where Testosterone provides the intent and background for sexual activity, Viagra provides the tool for it. This is why it has been advocated that a combination of the two would work better both in theory as well as practice. It has also been seen that combining Viagra with Testosterone yields a success rate as high as 98% in cases of Erectile Deficiency irrespective of cause, frequency and age of patients. Moreover, the quantity of either drug (given in combination) required to achieve this high success rate is also much lower than if given individually.

So far a detailed description of lack of testosterone causing andropause and the replacement of testosterone as treatment has been given, with a simple formula that there is a deficiency of testosterone that needs replacement. This is not as simple as it seems. testosterone though secreted by testes is maintained through a complex system of different organs and the hormones secreted by them. Therefore TRT should not only imply simple Testosterone Replacement but should be considered as a comprehensive hormonal replacement regimen. In men, the following hormones need special attention vis a vis andropause.³⁶

2. Human Growth Hormone

The replenishment of growth hormone from a deficient state can lead to an improved sex life; skin tone and can help to balance other hormones in the body including Testosterone, DHEA, melatonin, pregnenolone, and progesterone.

The quick way to reverse the declining human Growth Hormone (hGH) level is by hGH injections. A physician must monitor the injections. As with all hormones, growth hormone can be fatal if administered without proper precautions.

An alternative to hGH injections, oral preparations having precursors that stimulate the production of hGH are available. These are known as secretagogues and are preparations consisting of natural elements like amino acids, minerals and vitamins. Thus there are no side effects (rare). The results, though not as significant as injections, have been very encouraging. This is a recent development in preventing ageing. The authenticity of secretagogues therapy is not yet established. The secretagogues are not yet available in India but these are being used extensively in USA but it is not approved by Federal Drug Administration (FDA). Cenegenics³⁷ formula of secretagogues consists of Calcium (elemental) 1000mg, Magnesium Glycinate 400 mg, Manganese 12 mg, Boron 2 mg, Silica 100 mg, Vit D3 400IU, Vit K 150 microgram and Copper 2 mg. In addition to these elements there are certain other Amino Acids that are added to the prescription by some other firms.

Other ways to increase growth hormone release endogenously include intense strength training, cardiovascular exercises, calorie restrictions, and proper intake of nutraceutical supplementation, vitamins, antioxidants and amino acids such as glutamine, ornithine, and lysine that acts as pro-hormones.

3. DHEA

Many people have reported more energy, ability to handle stress more easily, think more clearly and generally feel better, after receiving DHEA. Other benefits in-

clude enhanced immunity (stronger resistance to colds, flu etc) and lower cholesterol levels.

It boosts antibody production; enhances the activity of monocytes and maximizes the anti-cancer function of immune cells known as T lymphocytes.

It is interesting to note that DHEA is not regulated by a negative feedback mechanism in the body. In other words, taking supplements of DHEA will not suppress the production of these hormones or cause the adrenal to rest and result in atrophy from the disuse. DHEA replacement therapy offers powerful health benefits and is virtually risk-free. The usual starting dose is 25 mg. Men may require a higher quantity (up to 100 mg) while women may need less (up to 50 mg).

4. Pregnenolone

Numerous studies have shown the effects of pregnenolone on the body and brain. It boosts energy, elevates mood and improves memory and mental performance. Pregnenolone also creates a sense of well being while improving the ability to tolerate stress. Furthermore, pregnenolone has a host of advantages which includes the ability to influence cerebral function, energy level, the female reproductive cycle, immune defenses, inflammation, mood, skin health, sleep patterns, stress tolerance, wound healing. Taking pregnenolone therefore normalizes and rejuvenates the entire adrenal cascade. The normal starting dose is 15 mg, increasing up to 100 mg for men or women. There are minimal side effects.

It is often recommended for anti-ageing purposes that both pregnenolone and DHEA be taken together. Since some

pregnenolone is converted into DHEA, the amount of DHEA intake can be lowered if both are taken together.

5. Melatonin

One of the causes of the disruptions of sleeping patterns during aging is the reduction in the nightly release of melatonin by the pineal gland. Many people have discovered that bedtime doses of melatonin restored their ability to obtain a sound and peaceful night's sleep.

Melatonin levels are known to decline drastically with age. It has been postulated that melatonin may even act to normalize (lower) gonadotropin levels. The exact dosage varies greatly between people. Trial and error is the best method. A higher dose does not mean more potency. Some people may feel better with a smaller dose. To normalize sleep and the bio-clock, a good dosage to start is 1 mg and should be gradually increased if there are no side effects.

6. Nutritional Supports

Andropause is a syndrome of degenerative disease characterized by age related diseases such as cardiovascular dysfunction, cancer and arthritis. One of the primary mechanisms of andropause may be oxidative stress from free radicals. Through improper diet, external pollutants, stress of life, our body's cells are continually bombarded by millions of free radicals each day. The degree and the amount of free radicals present in the body are related directly to the speed of the aging process.

Therefore, one of the primary goals of preventing andropause may be retarding the proliferation of free radicals through intake of food rich in anti-oxidants and antioxidants supplements.

While there is no established laboratory reference for the ideal intake level of antioxidants for anti-aging, many in the forefront of anti-Andropause research are advocating much higher levels of intake than the Recommended Dietary Allowance.

7. Proper Exercise

Exercise, in addition to its cardiovascular benefits, also increases the level of hormones in the body, which include growth hormone, Testosterone, DHEA and pregnenolone. Performing strength-training exercise is a key component because of the above-mentioned effects.

Following an anti-aging exercise program incorporating flexibility training, cardiovascular training, and strength training program in a balanced fashion is the key to preventing Andropause. It is strongly advised that none of the three components should be ignored.

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