LSAH

THE LONGITUDINAL STUDY OF ASTRONAUT HEALTH

Newsletter

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Pulmonary Function and Aging in LSAH

Reduced pulmonary function has been reported by a number of investigators as an important contributor to all-cause mortality independent of cigarette smoking. Specifically, forced expiratory volume in 1 second (FEV1) has been identified as a predictor of mortality. The pathobiology underlying this association is unclear. A reduced level of pulmonary function may be a proxy variable for other risk factors such as decreased physical activity, smoking-related injury, or leukocyte activity (increase in white blood cells).

Figure 1: *Baseline FEV1% for both astronauts and comparisons*

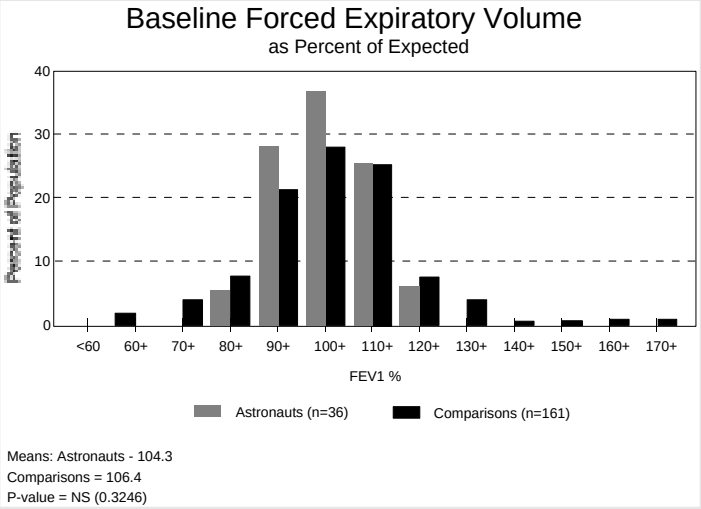
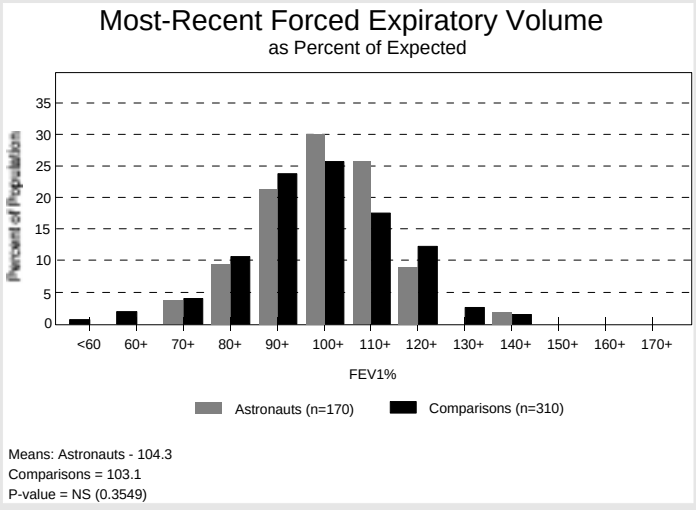


Figure 2: *FEV1% values measured at most recent visit*



LSAH participants undergo pulmonary testing as a part of the routine physical examinations, at which time FEV1 is measured. Because age and height are associated with the actual measure of FEV1, an adjusted value is also calculated. This adjusted value, reported as FEV1%, is a percentage of the expected value, given the standard population normal FEV1 values for age and height.

The LSAH database currently contains values for FEV1% from the pulmonary function tests completed at the baseline examination for 36 astronauts and 161 comparisons. There are values for FEV1% from the most recent visit for 170 astronauts and 310 comparisons. Both a baseline and a most recent measurement are available for 34 astronauts and 113 comparisons. The mean number of years between these specific baseline measurements and most recent visit measurements is 4.4 years for astronauts and 9.8 years for comparisons. All available data have not yet been data entered; therefore this look at the data is an interim analysis and not a final report.

The baseline FEV1% for both astronauts and comparisons are shown in Figure 1. The mean values of 104.3 for astronauts and 106.4 for comparisons are not statistically different. It is interesting however that the distribution of values is much wider for comparisons than for astronauts. The FEV1% values measured at the most recent visit are shown in Figure 2. The mean values are similar to the means at baseline and again are not statistically different. The range of values at the most recent visit is somewhat smaller than the range at baseline, and the range between the two groups is more similar at the most recent visit than at baseline. This difference at baseline may be a function of change in testing procedures over time, but it may also be a function of partial data entry.

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The thyroid gland: functions and disorders

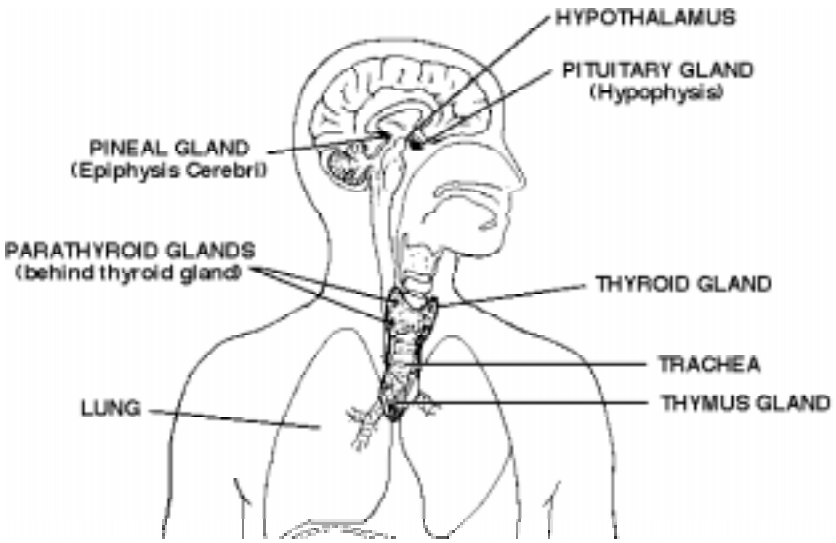
Your body has two kinds of glands: exocrine and endocrine. The exocrine glands (sweat glands, for example) secrete their products into ducts, which transport the secretions elsewhere. Endocrine glands do not have ducts. Their secretions (hormones) are released directly into the circulatory system.

Your thyroid is one of the endocrine glands, which also include the hypothalamus, pituitary, parathyroid, the adrenal glands, the pineal body and the gonads. As a participant in the LSAH, you will receive several thyroid function tests during your comprehensive physical examinations.

The thyroid gland is located in the lower front of the neck, as indicated in the figure, and consists of two lobes, one on either side of the trachea, connected by a thin bridge of tissue.

Receiving about 80-120 ml of blood per minute, the thyroid gland has a rich blood supply and can deliver high levels of hormones in a short period of time, if necessary. The amount of hormone that is released depends on the body's need for that hormone at any given time. One of the thyroid's unique features is its ability to store hormones and release them in a steady flow over a long period of time.

The thyroid hormones' effect on the body is, primarily, to regulate:
1) metabolism and energy balance,
2) growth and development, and
3) activity of the nervous system.
The thyroid gland secretes, stores, and liberates the thyroid hormones, thyroxine (T_4) and tri-iodothyronine (T_3). They are referred to as T_4 and T_3, respectively, because of the number of atoms of iodine they contain. T_4 and T_3 strongly influence the body's metabolic rate by increasing oxygen consumption and heat production of most body tissues.



Thyroid Function Tests

Several thyroid function tests are performed for LSAH participants at the comprehensive physical examinations. The compounds that are measured are thyroid stimulating hormone (TSH), thyroxine (T_4), and tri-iodothyronine (T_3). TSH is released by the anterior pituitary gland. It stimulates the secretion of T_4 and T_3 by the thyroid gland. T_4 and T_3 are the major hormones produced by the thyroid. Their chief function is to increase the rate of cell metabolism. The degree of absorption and incorporation of iodine by the thyroid is assessed using the T_3 uptake test. In addition, the free thyroxine index is calculated by multiplying T_4 and T_3 uptake measurements to provide a more precise measure of an individual's true hormonal status than T_4 or T_3 determinations.

Graves' disease and toxic multinodular goiter are characterized by elevated T_4 and T_3 uptake, and free thyroxine index values and abnormally low levels of TSH. Elevated levels of TSH combined with low levels of T_3 and T_4 indicate primary hypothyroid states such as Hashimoto's disease, and congenital hypothyroidism. Secondary hypothyroidism, as seen in individuals with thyroiditis, pituitary disorders, or post-thyroidectomy, is indicated by suppressed levels of TSH, T_3, and T_4. The free thyroxine index and T_3 uptake test are useful in diagnosing hyperthyroidism and hypothyroidism. High levels suggest hyperthyroidism; low values suggest hypothyroidism.

If your thyroid function test results are within normal ranges, your physician will most likely not mention them during discussion of pertinent findings of your physical examination. However, if one or more of the test results are higher or lower than normal, referral for further testing will probably be recommended.

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Thyroid Disorders

Goiter is an enlargement of the thyroid gland, causing a swelling in the front part of the neck. Goiters caused by insufficient intake of iodine may be reversed by administration of small amounts of iodine, as little as 4 grams per year. A goiter is a symptom of both hyperthyroidism and hypothyroidism caused by overworking of the thyroid gland.

Hyperthyroidism is a condition of excessive functional activity of the thyroid gland and excess secretion of thyroid hormones. Symptoms for this disorder, which occurs mostly in women, include goiter, rapid heart rate (more than 100 beats per minute), irregular heart beat, fatigue, nervousness, heat intolerance, weight loss, depression, high blood pressure, and protruding eyes.

Graves' disease causes 80 percent of all cases of hyperthyroidism and tends to affect women between 20 and 40 years of age. In Graves' disease, the body produces an antibody that stimulates the thyroid to overproduce thyroid hormones resulting in hyperthyroidism accompanied by goiter.

Another cause of hyperthyroidism is toxic multinodular goiter, also known as Plummer's syndrome. A multinodular goiter is an enlarged thyroid gland with lumps or nodules on it. The nodules mimic the functions of the thyroid gland by producing thyroid hormones. Since the thyroid gland continues to produce thyroid hormones too, hyperthyroidism results. This disorder is more commonly seen in women over 60 years of age.

Treating hyperthyroidism might involve surgical removal of the thyroid—a procedure called thyroidectomy. However, surgery is usually performed only when the thyroid gland has developed nodules or has become cancerous. The more common treatment for hyperthyroidism is to render the thyroid gland inactive with radioactive iodine. The thyroid naturally absorbs iodine to function, so treatment with radioactive iodine destroys the thyroid tissue. There are usually no side effects in adults, but radioactive iodine is not usually used in patients under 20 years of age. It is also very important to be sure the patient is not pregnant at the time of treatment of hyperthyroidism with radioactive iodine.

After treatment of hyperthyroidism by thyroidectomy or radioactive iodine, patients will have to take synthetic thyroid replacement hormone for the rest of their lives.

Hypothyroidism is a deficiency of thyroid activity. It is seven to eight times more common in women than in men. The rates of hypothyroidism increase with age. Hypothyroidism is characterized by a decrease in basal metabolic rate, tiredness and lethargy, sensitivity to cold, and menstrual disturbances.

As with hyperthyroidism, there are several causes of hypothyroidism. Hashimoto's disease is a progressive autoimmune disease of the thyroid gland and the cause of about 60 percent of hypothyroidism cases. Like Graves' disease, Hashimoto's disease is caused by abnormal antibodies and white blood cells attacking and damaging thyroid cells. Unlike Graves' disease, this results in eventual destruction of sufficient thyroid cells to cause hypothyroidism. The inflammation may cause a goiter to develop but in some cases the thyroid gland shrinks. Often the patient experiences mild or no symptoms, and Hashimoto's disease may go undetected for years until the thyroid function is so inadequate that symptoms of hypothyroidism occur. Hashimoto's disease tends to run in families and is more common in women over 40 years of age. Treatment consists of replacement therapy with synthetic thyroid hormone preparations for life.

Congenital hypothyroidism occurs when a baby is born with no thyroid gland. This is a very rare but very serious condition because brain development and physical growth are

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If you want a copy of your exam results,

please complete and sign a release form while you are visiting the Clinic for your examination.

The form is called *Privacy Act Disclosure Authorization and Accounting Record (DAAR)*, or NASA Form 1536.

Pulmonary function continued from page 1

Whether an association will be seen between forced expiratory volume and mortality in this population remains to be seen. Because of the theory that FEV1 may be a proxy measure for physical activity, we also looked at the association between FEV1% and volume of oxygen consumed per kilogram of body weight per minute measured during exercise testing. The volume of oxygen consumed during exercise testing is an indicator of physical fitness. We found no association between these two variables in this small data set. These data will be reevaluated when all data have been entered to the data base.

Thyroid disorders continued from page 3

dependent on thyroid hormone. Left untreated, the baby could be severely mentally retarded and suffer from growth defects. In North America, babies are tested two days after birth for hypothyroidism, and, if diagnosed, treated with thyroid replacement hormone. Treatment will result in normal physical growth and brain development. Congenital hypothyroidism may also result from dietary iodine deficiency in the mother. This is common in areas of the world where iodine is not readily available. In countries where table salt is iodized, this problem has been eradicated for the most part.

Thyroiditis is an inflammation of the thyroid with symptoms of either hyperthyroidism or hypothyroidism. This condition may be caused by a virus, such as subacute viral thyroiditis, which may last up to six weeks. Mild cases are treated with anti-inflammatory medications such as aspirin until the infection clears. Silent thyroiditis is similar to subacute viral thyroiditis but the cause is unknown. The disease usually runs its course in a short period of time and clears up by itself. After childbirth as many as 10 percent of women experience a type of silent thyroiditis called postpartum thyroiditis. The thyroiditis may go untreated because the symptoms are attributed to "postpartum blues" or the natural fatigue which follows childbirth. The thyroiditis usually only lasts for a few weeks and clears up by itself. However women who experience postpartum thyroiditis once usually experience it in subsequent pregnancies and may be predisposed to develop permanent thyroid disorders later. Acute thyroiditis is painful inflammation of the thyroid gland caused by a severe bacterial infection. The thyroid gland becomes painful and inflamed and may be accompanied by high fever and chills. This condition is treated with antibiotics.

If you have a new address or phone number,

***please let us know by calling* (713) 212-1362 or (713) 483-5785**

or write us at

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