

AMERICAN BRAIN TUMOR ASSOCIATION

Pituitary Tumors



American
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ACKNOWLEDGEMENTS

ABOUT THE AMERICAN BRAIN TUMOR ASSOCIATION

Founded in 1973, the American Brain Tumor Association (ABTA) was the first nonprofit advocacy organization dedicated solely to brain tumor research. For nearly 45 years, the Chicago-based ABTA has been providing comprehensive resources that support the complex needs of brain tumor patients and caregivers, as well as the critical funding of research in pursuit of breakthroughs in brain tumor diagnosis, treatment and care.

To learn more about the ABTA, visit www.abta.org

We gratefully acknowledge the assistance of Edward R. Laws, Jr., MD, FACS Department of Neurosurgery, Brigham & Women's Hospital and Sherry L. Iuliano, MSN, NP-C (Nurse Practitioner) Pituitary/ Neuroendocrine Center, Brigham & Women's Hospital for technical review of this publication.

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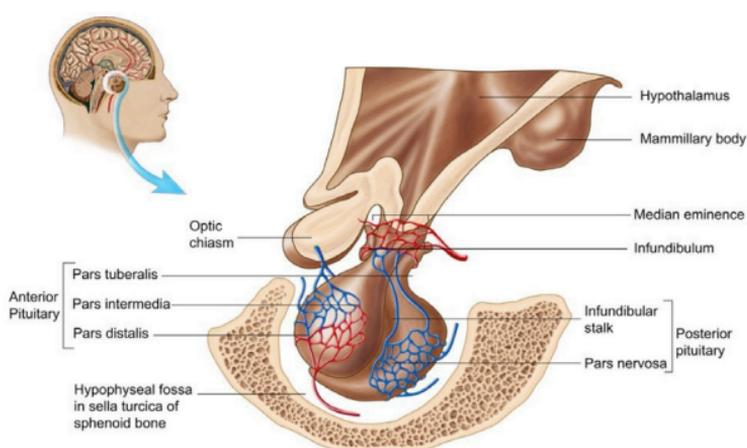
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Pituitary Tumors

INTRODUCTION

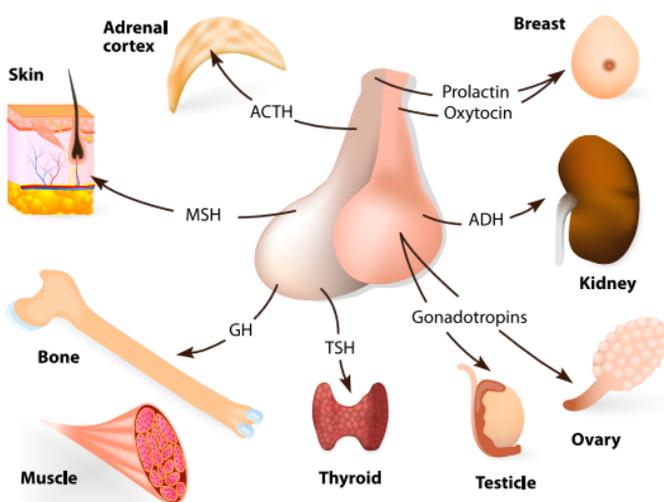
The pituitary gland is a bean-sized organ located in the midline at the base of the brain, just behind the bridge of the nose, in a bony pouch called the “sella turcica.”



The pituitary itself is known as the “master gland” because it helps to control the secretion of hormones from a number of other glands and target organs in the body. These include the thyroid, adrenals, testes and ovaries. The pituitary gland releases hormones into the blood stream, where they are carried to distant glands or organs in the body. Those distant glands release other hormones which, in turn, feed back to the brain and the pituitary through the bloodstream. Once

back in the brain, hormones cause the hypothalamus (a part of the brain near the pituitary) to signal the pituitary gland to secrete more hormones or slow down hormone production, depending on the needs of the body. A stem-like stalk connects the pituitary gland to the hypothalamus and it is through this stalk that the hypothalamus sends signals to control the activity of the pituitary gland.

ENDOCRINE GLANDS (Target Organs)



The medical term for the most common type of pituitary tumor is pituitary adenoma — adeno means gland, oma means tumor. Most pituitary adenomas develop in the front two-thirds of the pituitary gland. That area is called the adenohypophysis, or the anterior pituitary. Pituitary tumors rarely develop in the rear one-third of the pituitary gland, called the neurohypophysis or the posterior pituitary. The tumors are almost always benign and most are very successfully treatable.

Some tumors can be treated effectively with medications while others require surgery. Because the pituitary gland is important in the control of other glands in the body, treating a pituitary tumor requires an active coordinated multi-disciplinary health care approach, support and follow-up.

INCIDENCE

Pituitary tumors account for 12 -19 percent of all primary brain tumors, making them the third most common primary brain tumor in adults, following meningiomas and the gliomas. Studies of the general population reveal that abnormalities including small tumors and benign cysts within the pituitary are quite common. Although exact statistics are not yet available on these tumors (registries only recently began counting pituitary tumors in their data), it is estimated that 20 – 25 percent of the general population may have small, symptomless pituitary tumors or cysts. It appears that 10 percent of the general population will have an abnormality big enough to see on magnetic resonance imaging (MRI). These abnormalities most often do not cause symptoms, and generally do not require medical or surgical therapy.

Pituitary tumors can be found in every age group, but their incidence tends to increase with age. Functioning (also called secreting) tumors most frequently occur in younger adults. Non-functioning (non-secreting) tumors tend to occur in older adults. Women are diagnosed with pituitary tumors slightly more often than men. This may be a result of a tumor's interference with the menstrual cycle, which sometimes makes symptoms more obvious.

CAUSES

Pituitary tumors, similar to tumors located elsewhere in the body, are presumed to develop from one single abnormal cell that multiplies into many secondary cells, eventually forming a tumor. Stimulating factors from the hypothalamus may also contribute to tumor occurrence and growth. If your doctor concludes that you have a pituitary tumor, the next step is determining the actual “type” of pituitary tumor.

TYPES OF TUMORS

Pituitary tumors may be classified and named by:

- The hormones they secrete, if any
- Their size
- The appearance of the tumor cells under a microscope

HORMONES

Some pituitary tumors secrete excessive amounts of a particular hormone. These are known by several names including functioning adenomas, hormonally active adenomas and secretory adenomas. Functioning, or secreting tumors may cause the pituitary gland to ignore the signals from the hypothalamus, allowing the pituitary gland independently to secrete excessive amounts of hormones such as prolactin (PRL), growth hormone (GH), adrenocorticotrophic hormone (ACTH), or thyroid-stimulating hormone (TSH).

Sometimes these tumors secrete more than one type of hormone. Other pituitary tumors do not oversecrete any active hormone at all, and may even cause a slow down or a stoppage in hormone production (a condition called hypopituitarism). These tumors are commonly called nonfunctioning adenomas (NFAs). Other names for these nonsecreting tumors include “hormonally inactive” or “non-secretory adenomas.”

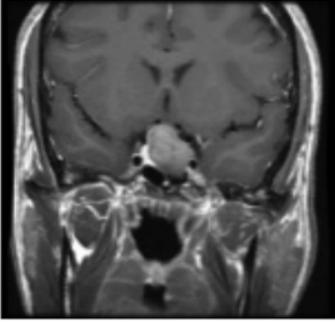
SIZE

Pituitary tumors are also classified by their size. Tumors appearing to be 10 mm or less (about 3/8”) in diameter on an MRI scan are called microadenomas. Those larger than 10 mm are called macroadenomas.

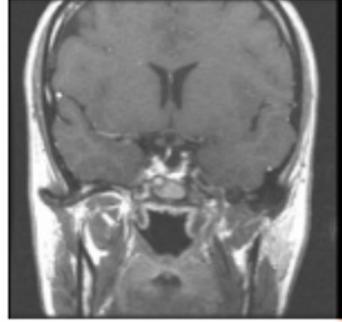
MRI of a Pituitary Macroadenoma (Pre and Postoperative)

MRI SCANS

Preoperative



Postoperative

**MICROSCOPIC APPEARANCE**

If your tumor is surgically removed, it will be examined by a pathologist — a doctor trained to look at tumor cells using a microscope and to use special staining (coloring the tissues) procedures to characterize each tumor. The pathologist will examine the sample of tumor tissue and provide a report to your doctor. The “pathology report” describes the hormone content, structure and the cells that gave rise to your tumor. It usually takes about a week for your doctor to receive the surgical pathology report. All of this information is then used to determine your tumor type, form a treatment plan and predict the possible future activity of the tumor. Pituitary tumors are almost always benign (not cancer), but they can recur after treatment.

SYMPTOMS

Since almost 70 percent of pituitary tumors are functional, or secreting tumors, the most common symptoms are related to excess hormone production. Lack of menstrual periods (amenorrhea), production of breast milk without pregnancy (galactorrhea), excessive growth (acromegaly or gigantism), Cushing’s syndrome,

and/or a hyperactive thyroid may be clues to the presence of a tumor in the gland. Headache, vision changes, sleep and eating disorders, and excessive thirst and urination (diabetes insipidus) may also be noted.

Hormonally non-functioning tumors usually have symptoms of headache, visual loss, fatigue and loss of energy. The latter symptoms are caused by hypopituitarism. This results from compression of the normal pituitary gland by the tumor.

DO YOU BELIEVE YOU HAVE A PITUITARY TUMOR?

If you have symptoms causing you concern, begin by making an appointment to see your family doctor or your primary care physician. Explain your symptoms, and be a good historian. How long have you been experiencing the symptoms? Have they changed any since your symptoms first began? Share your concerns and your medical history. Your doctor can order a few basic tests (blood work and/or a scan) that will help determine the next step. There are many diseases that can cause hormone-related symptoms; not all of them are tumors. Your primary care physician can help you sort through your symptoms and make the appropriate referrals if necessary. An endocrinologist - a physician specially trained in the treatment of disorders of the hormone-producing glands - may be very helpful in clarifying the diagnosis and in managing medical therapy.

DIAGNOSIS

If your healthcare provider suspects you have a tumor, several tests are available that can help determine the diagnosis. Special blood tests can measure your

hormone levels and whether the pituitary gland is the source of any excess hormone.

Following a neurological exam and endocrine screening (blood hormone levels), an MRI scan with contrast dye is used to obtain images of the pituitary gland, the sella

Hormone	Responsible for ...	Normal Blood Levels in Adults
ACTH adrenocorticotrophic hormone	Controls the production of cortisol – a natural steroid needed to control blood pressure, sugar and salt levels	9 to 52 ng/ml
GH growth hormone	Controls bone growth; height; body proportion in the extremities and jaw	0 to 3 ng/ml
PRL prolactin	Controls milk production in women, impacts sex drive and sperm counts in men	Males and non-pregnant women: 0 to 20 ng/ml In pregnancy: 10 to 300 ng/ml
TSH thyroid stimulating hormone	Controls thyroid functions such as metabolism, heart rate and appetite	0.5 to 5.7 mIU/L

and the area around it. In some circumstances, scans of the chest or abdomen may be necessary to verify that the hormone imbalances are caused by the pituitary gland. An ophthalmologist — a doctor specializing in visual problems — may examine your eyes if the tumor affects your eyesight and impairs peripheral vision.

Sometimes, pituitary tumors are found “incidentally.” This usually means the tumor was seen on an MRI scan ordered for another, unassociated medical reason such as a sports-related accident, head injury, sinus disease,

and neck pain. These symptomless tumors require careful evaluation, but may not always need immediate treatment.

SPECIFIC TYPES OF PITUITARY TUMORS

PROLACTINOMAS, OR PROLACTIN-PRODUCING ADENOMAS

Prolactinomas represent about 30 – 40 percent of all pituitary tumors, making them the most common subtype of these tumors. Prolactinomas are most often found in women of childbearing age. In men, prolactinomas are more frequent in the fourth and fifth decades of life. About half of these tumors are microadenomas, which are small tumors.

In women, high prolactin levels may cause menstruation to stop (amenorrhea) or inappropriate production of breast milk (galactorrhea), and loss of libido may develop. In men, prolactin secreting tumors may cause a decreased sex drive and impotence. Men also tend to develop larger tumors which may cause headaches or vision problems.

GROWTH HORMONE - PRODUCING ADENOMAS (ACROMEGALY AND GIGANTISM)

These tumors represent about 20 percent of pituitary adenomas. Growth hormone-producing tumors are more common in men than in women. Often macroadenomas, these tumors may extend toward the cavernous sinus, an area of the brain located next to the pituitary. Mixed prolactin and growth hormone-secreting tumors are not uncommon.

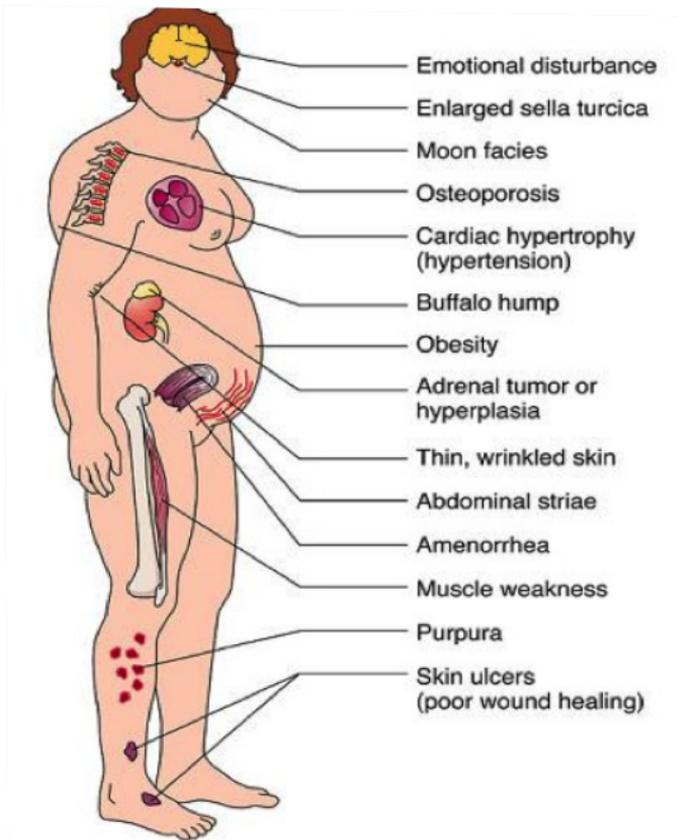
Growth hormone-secreting tumors may cause gigantism in children and adolescents. In adults who have reached their full height, the hands, feet, and

lower jaw become enlarged. This is called acromegaly. Excessive growth hormone can aggravate other medical conditions such as diabetes mellitus, hypertension and heart disease.

ACTH-PRODUCING ADENOMAS

These tumors represent about 16 percent of the pituitary adenomas. They are much more common in women than in men. ACTH (adrenocorticotrophic hormone) stimulates the adrenal gland to make and secrete glucocorticoids,

MANIFESTATIONS OF CUSHING'S DISEASE



which are natural steroids. Excess glucocorticoids cause Cushing's syndrome. Some of the symptoms of Cushing's disease are a moon-shaped face, excess hair growth on the body, bruising, menstrual irregularities and high blood pressure.

OTHER HYPERSECRETING PITUITARY ADENOMAS

This group represents less than 1 percent of pituitary adenomas. Some of these tumors excrete increased amounts of thyrotropin (thyroid stimulating hormone). Others may secrete follicle stimulating hormone/luteinizing hormone, which controls the ovaries and testes, or alpha subunit, an inactive glycoprotein hormone.

NON-SECRETING TUMORS

Also called non-functioning tumors, these represent about 25 percent of the pituitary adenomas. Null cell adenomas, oncocytomas, silent corticotroph adenomas and silent gonadotroph and thyroph adenomas fall into this group. These tumors grow slowly and generally cause minimal symptoms. They may be sizable before their presence is suspected. When they expand outside the sella turcica, they may press on the nearby optic nerves causing vision loss and headache. Such tumors can also compress the pituitary gland itself so it cannot produce and deliver its normal output of hormones. Called hypopituitarism, this symptom is associated with general weakness and fatigue, a pale complexion, loss of sexual function and apathy.

PITUITARY CARCINOMA

Cancers of the tissue of the pituitary gland are very rare. Instead, a pituitary carcinoma is usually defined as a tumor that begins in the pituitary gland and then metastasizes, or spreads, within the brain or outside the central nervous system. These tumors are generally macroadenomas which are resistant to therapy, recur locally and ultimately metastasize to the spinal canal or other organs of the body. The majority of pituitary carcinomas are functional tumors, secreting prolactin or ACTH.

TREATMENT

Treatment of a pituitary tumor depends on the hormonal activity of the tumor, the size and location of the tumor, as well as the age and overall health of the person with the tumor. The goals of treatment may be to remove the tumor, to reduce or control tumor size, and/or to re-balance hormone levels.

DRUG THERAPY

There are several drugs used to treat pituitary tumors. The drug chosen will depend on the hormone functions of the tumor.

Dopamine agonists, such as bromocriptine or cabergoline are used to control the production of prolactin. These drugs can reduce tumor size and normalize the amount of prolactin made by the pituitary gland. Most people with prolactin-secreting tumors require long-term drug therapy to control the size of their tumor; generally, if the medication is stopped prolactin levels begin to increase. In a small percentage of people with very small tumors, treatment may be stopped after some years to see if the tumor re-grows.

Those with very high prolactin levels may find that drug therapy decreases their hormone levels but does not relieve all of their symptoms. In these situations, the drug successfully lowers the prolactin level but the level may still be higher than “normal,” and may still cause symptoms.

Somatostatin analogues such as octreotide (Sandostatin or Sandostatin LAR, or Lanreotide) can reduce growth hormone levels and relieve the associated symptoms. These drugs may also be used to control the production of thyroid stimulating hormone in thyrotropic tumors.

A growth hormone receptor antagonist drug called pegvisomant (Somavert) can be effective in normalizing a protein called IGF-1, found in elevated levels in people with acromegaly. The drug may be used when other

approaches such as surgery, radiation, or somatostatin analogues are not successful.

Dopamine agonists, such as those listed above, can be given to treat growth-hormone secreting tumors, but their effect is primarily relief of symptoms rather than reduction of hormone levels to normal.

Ketoconazole (Nizoral) is used to treat ACTH secreting tumors that produce Cushing's disease. This drug lowers cortisol (natural steroid) production, but generally does not reduce the size of the tumor or inhibit its activity, and is not suitable for long-term treatment. Recently, two new drugs have been released for treatment of Cushing's disease. They are pasireotide and mifepristone. These drugs have specific indications, some side effects, and are not actually able to cure the tumor.

Newer drugs are being considered in research studies called clinical trials; information about these trials can be found through your endocrinologist.

SURGERY

If your doctor recommends surgery, the goal will be to remove as much tumor as possible. A “transsphenoidal approach”—literally meaning “through the sphenoid sinus”—is the most common. During this surgery, extremely small instruments, microscopes and endoscopes are used to remove the tumor from within the nose (endonasal) or under the lip and above the teeth (sublabial). Less often, a craniotomy may be done, during which a portion of the skull bone is temporarily removed to gain access to the pituitary gland. Some surgeons use endoscopes (a long, thin, tube-like instrument) to reach the tumor.

Your neurosurgeon will speak with you about the surgery planned for your tumor, the risks and benefits of the procedure and your follow-up care. We offer a free publication, titled *Surgery*, which explains the

different surgical tools available, how procedures are planned, and questions to ask your physician about the procedure recommended for you. If you would like a copy, please call us at 800-886-2282.

RADIATION THERAPY

Radiation therapy or radiosurgery are sometimes used as second, or adjuvant, treatments for pituitary tumors. They may be given in addition to surgery and/or drug therapy. Radiation therapy may be used to treat tumors that have re-grown, or it may be used for aggressive tumors. The goal of radiation therapy for pituitary tumors is to reduce or control tumor size; however, it may take several months or longer before the effects of this treatment cause a change in your hormone levels or your MRI scan. There are several different types of radiation therapy; your doctor will suggest which may be best for your tumor. Conventional fractionated external beam radiation is “standard” radiation usually given 5 days a week for 5 or 6 weeks.

Stereotactic radiosurgery is focused radiation therapy. The Gamma Knife, LINAC (modified linear accelerators), CyberKnife and proton beam radiation are all forms of stereotactic radiosurgery. Conformal photon radiation, also known as intensity-modulated radiation therapy, shapes radiation beams to the contours of the tumor. If your doctor thinks your tumor would be best treated with radiation, he/she can initiate an appropriate referral for information about the type of therapy suggested and the effects of that particular treatment.

FOLLOW-UP

Once you recover from surgery or radiation therapy, or begin medical treatment, your doctors will determine a schedule for follow-up MRI scans and endocrine testing. These are used to monitor the effectiveness of therapy, assure normal hormonal balance and watch for possible tumor re-growth.

Many people with pituitary tumors are followed regularly by an endocrinologist. Hormone imbalances can be caused by the tumor itself, or may result from the treatment necessary to control the tumor. The endocrinologist will monitor your hormone blood levels, outline a treatment plan and make drug adjustments when needed. The endocrinologist and the advanced practice nurses on both the endocrinology and neurosurgery teams become active members of your healthcare team, working closely with your internist or primary care physician.

Although pituitary tumors are almost always benign, they can recur, and therefore periodic follow-up MRI scans are necessary. Your doctor will tell you how often those scans should be done. If you do not know when your next MRI should be scheduled, call your doctor's office to ask.

THE ABTA IS HERE FOR YOU

You don't have to go through this journey alone. The American Brain Tumor Association is here to help.

Visit us at www.abta.org to find additional brochures, view free, educational webinars on demand, read about research and treatment updates, connect with a support community, join a local event and more.

We can help connect patients and caregivers with information and resources that can help support them in the brain tumor journey. Our team of caring professionals are available via email at abtacares@abta.org or via our toll-free CareLine at 800-886-ABTA (2282).

We have added some references that should be useful. They describe Pituitary Tumors in general, and also give details about the specific subtypes that are encountered.

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AMERICAN BRAIN TUMOR ASSOCIATION PUBLICATIONS AND SERVICES

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About Brain Tumors: A Primer for Patients and Caregivers

Brain Tumors – A Handbook for the Newly Diagnosed*

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Most publications are available for download in Spanish.

*Exceptions are marked **

CLINICAL TRIALS

TrialConnect®: www.abtatrialconnect.org or 877-769-4833

More brain tumor resources and information
are available at www.abta.org.

AMERICAN BRAIN TUMOR ASSOCIATION

8550 W. Bryn Mawr Avenue, Suite 550
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