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About Pituitary Tumors

Overview and Types

If you have been diagnosed with a pituitary tumor or worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- [What Are Pituitary Tumors?](#)

Research and Statistics

See the latest estimates for new cases of pituitary tumors in the US and what research is currently being done.

- [Key Statistics About Pituitary Tumors](#)
 - [What's New in Pituitary Tumor Research?](#)
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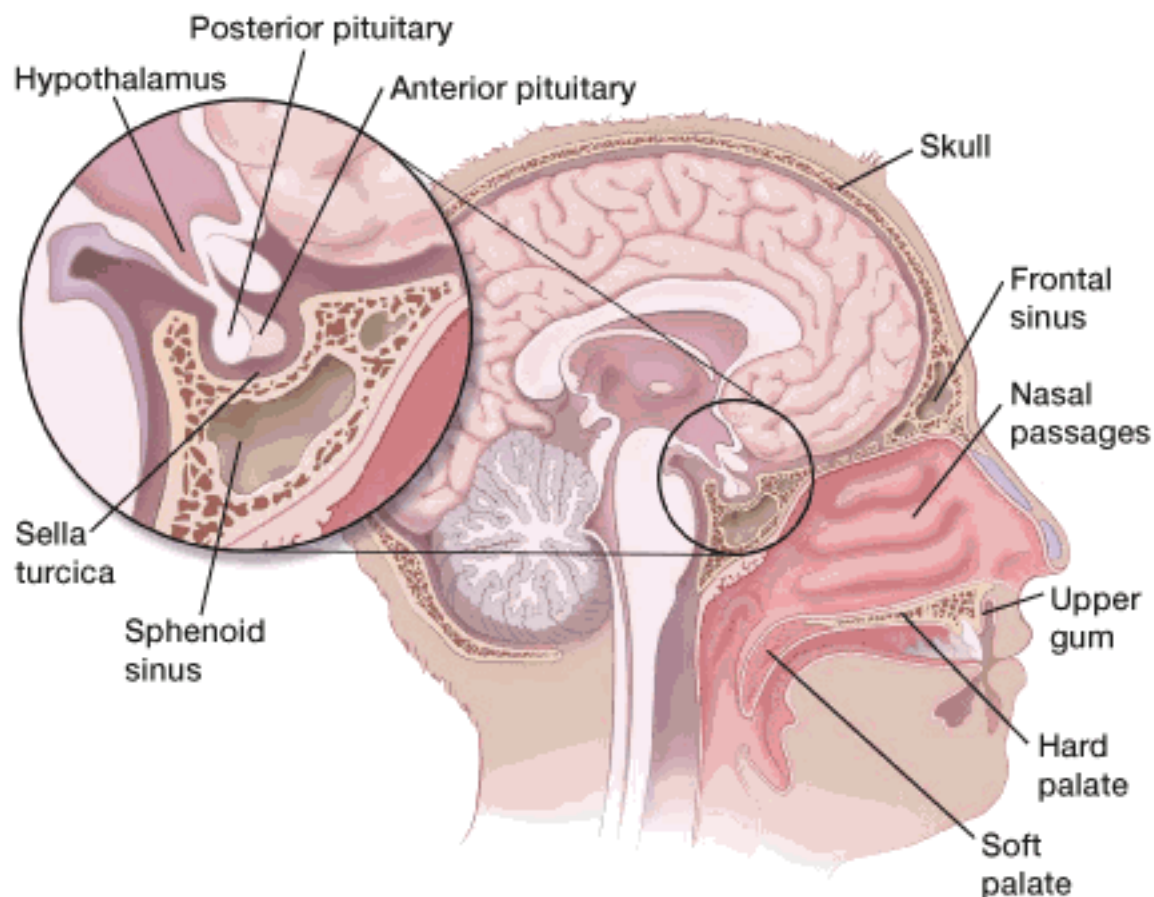
What Are Pituitary Tumors?

A tumor is an abnormal growth of cells. Tumors can start nearly anywhere in the body. Tumors that start in the pituitary gland are called *pituitary tumors*.

To understand pituitary tumors, it helps to know about the normal pituitary gland and what it does.

The pituitary gland

The pituitary is a small gland found inside the skull just below the brain and above the nasal passages, which are above the fleshy back part of the roof of the mouth (known as the *soft palate*). The pituitary sits in a tiny bony space called the *sella turcica*. The nerves that connect the eyes to the brain, called the *optic nerves*, pass close by it.



The pituitary gland is connected directly to part of the brain called the *hypothalamus*. This provides a key link between the brain and the *endocrine system*, a collection of glands in the body that make hormones. **Hormones are substances released into the blood that control how other organs work.** The hypothalamus releases hormones into tiny blood vessels connected to the pituitary gland. These then cause the pituitary gland to make its own hormones. The pituitary is considered the “master control gland” because it makes the hormones that control the levels of hormones made by most of the other endocrine glands in the body.

The pituitary gland has 2 parts, the anterior pituitary and the posterior pituitary. Each has distinct functions.

Anterior pituitary

Most pituitary tumors start in the larger, front part of the pituitary gland known as the anterior pituitary. This part of the gland makes these hormones that control other endocrine glands:

- **Growth hormone** (GH, also known as *somatotropin*) promotes body growth during childhood. If too much is made in a child they will grow very tall. Normally, adults make only small amounts of growth hormone. If an adult makes too much growth hormone, the bones of the hands, feet, and face continue to grow and become quite large, causing their normal features to become distorted. (This condition is called *acromegaly*.)
- **Thyroid-stimulating hormone** (TSH, also called *thyrotropin*) stimulates growth of the thyroid gland and the release of thyroid hormone. Thyroid hormone regulates metabolism. Too much makes you hyperactive and shaky, and too little makes you sluggish. If a pituitary tumor makes too much TSH, it can cause hyperthyroidism (an overactive thyroid gland).
- **Adrenocorticotropic hormone** (ACTH, also known as *corticotropin*) causes the adrenal glands to grow and to make steroid hormones (such as cortisol). Too much ACTH from the pituitary causes Cushing's disease, the symptoms of which can include rapid weight gain and the build-up of fat in certain parts of the body.
- **Luteinizing hormone (LH)** and **follicle-stimulating hormone (FSH)** are also called *gonadotropins*. In women their main effects are on the ovaries, where they control ovulation (the release of eggs) and the production of the hormones estrogen and progesterone. In men, LH and FSH control testosterone and sperm production in the testicles.
- **Prolactin** causes milk production in the female breast. Its function in men is not known.

Posterior pituitary

The smaller, back part of the pituitary gland, called the posterior pituitary, is really an extension of brain tissue from the hypothalamus. The posterior pituitary is where hormones made by the hypothalamus (vasopressin and oxytocin) are stored and released into the bloodstream.

- **Vasopressin** (also called *antidiuretic hormone*, or ADH) causes the kidneys to keep water in the body and not lose it all in the urine. Without vasopressin, a

person urinates too much and becomes dehydrated. This condition is called *diabetes insipidus*. Vasopressin also can raise blood pressure by causing blood vessels to constrict. It might have other functions as well.

- **Oxytocin** causes the uterus to contract in women during childbirth and the breasts to release milk when a woman nurses her baby. It might have other functions in both men and women.

Tumors rarely start in the posterior pituitary.

Pituitary tumors

Almost all pituitary tumors are benign (not cancer) glandular tumors called *pituitary adenomas*. These tumors are called benign because they don't spread to other parts of the body, like cancers can. Still, even benign pituitary tumors can cause major health problems because they are close to the brain, may invade nearby tissues (like the skull or the sinuses), and because many of them make excess hormones.

Pituitary cancers (called *pituitary carcinomas*) are very rare.

Pituitary adenomas

These benign tumors do not spread outside the skull. They usually stay in the sella turcica (the tiny space in the skull that the pituitary gland sits in). Sometimes they grow into the bony walls of the sella turcica and nearby tissues, like blood vessels, nerves, and sinuses. They don't grow very large, but they can have a big impact on a person's health.

There is very little room for tumors to grow in this part of the skull. So, if the tumor gets larger than about a centimeter (about half an inch) across, it may grow upward, where it can press on and damage nearby parts of the brain and the nerves that arise from it. This can lead to problems like vision changes or headaches. (See [Signs and Symptoms of Pituitary Tumors¹](#).)

Microadenoma versus macroadenoma

Pituitary adenomas can be divided into 2 categories based on size:

- **Microadenomas** are tumors that are smaller than 1 centimeter (cm) across. Because these tumors are small, they rarely damage the rest of the pituitary or

nearby tissues. But they can cause symptoms if they make too much of a certain hormone. Many people actually have small adenomas that are never found because they don't grow large enough or make enough hormones to cause a problem.

- **Macroadenomas** are tumors 1 cm across or larger. Macroadenomas can affect a person's health in 2 ways. First, they can cause symptoms if they make too much of a certain hormone. Second, they can cause symptoms by pressing on normal parts of the pituitary or on nearby nerves, such as the optic nerves.

Functional versus non-functional adenoma

Pituitary adenomas are also classified by whether they make too much of a hormone and, if they do, which type they make. If a pituitary adenoma makes too much of a hormone it's called *functional*. If it doesn't make enough hormones to cause problems it's called *non-functional*.

Functional adenomas: Most of the pituitary adenomas that are found make excess hormones. The hormones can be detected by blood tests or by tests of the tumor when it is removed with surgery. Based on these results, pituitary adenomas are classified as:

- **Lactotroph adenomas** make prolactin and account for about 4 out of 10 pituitary tumors.
- **Somatotroph adenomas** make growth hormones and make up about 2 in 10 pituitary tumors.
- **Corticotroph adenomas** make ACTH and account for about 1 in 10 pituitary tumors.
- **Gonadotroph adenomas** make LH and FSH and are very rare.
- **Thyrotroph adenomas** make TSH and are very rare.
- **Plurihormonal adenomas** make more than one hormone.
- **Null cell adenomas** do not make hormones. (These are non-functional adenomas.)

The kind of hormone an adenoma makes strongly affects what signs and symptoms it causes. It also affects which [tests are used for diagnosis](#)², the [choice of treatment](#)³, and the patient's outlook.

Non-functional adenomas: Pituitary adenomas that don't make excess hormones are called *non-functional adenomas* or *null cell adenomas*. They account for about 3 in 10

of all pituitary tumors that are found. They are usually found as macroadenomas, causing symptoms because of their size as they press on nearby structures.

Pituitary carcinomas

Cancers of the pituitary gland are rare. Only a few hundred have ever been described in medical journals. They can occur at any age, but most are found in older people. These cancers usually make hormones, just like many adenomas do.

Pituitary carcinomas look like pituitary adenomas under a microscope, so doctors have trouble telling them apart. In fact, the only way to tell if a pituitary tumor is a carcinoma and not an adenoma is when the tumor spreads to another part of the body not near the pituitary gland. Most often pituitary carcinoma spreads to the brain, spinal cord, meninges (the covering of the brain and spinal cord), or bone around the pituitary. Rarely, these cancers spread to other organs such as the liver, heart, or lungs.

One of the key issues with pituitary tumors is that there's currently no way to know if a benign pituitary adenoma will become cancer and grow and spread to other parts of the body.

Other tumors of the pituitary region

There are several other types of benign tumors that grow in the region of the pituitary, as well as some malignant (cancerous) ones. All are much less common than pituitary adenomas.

Teratomas, germinomas, and choriocarcinomas are all rare tumors that usually occur in children or young adults. They don't develop from the hormone-making cells of the pituitary gland itself, but they can grow into the pituitary and damage it.

Rathke cleft cysts and gangliocytomas of the pituitary are rare tumors that are usually found in adults.

Craniopharyngiomas are slow-growing tumors that start above the pituitary gland but below the brain itself. They sometimes press on the pituitary and the hypothalamus, causing hormone problems. They're more common in children, but they can be seen in older adults. For more on these tumors, see [Brain and Spinal Cord Tumors in Children](#)⁴.

Cancers that start in some other parts of the body (like the breast) can sometimes spread to the pituitary. These cancers are classified and treated based on where they started (their primary site) and are not thought of as pituitary tumors.

The rest of our information focuses mainly on benign pituitary tumors (pituitary adenomas).

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
2. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/how-diagnosed.html
3. www.cancer.org/cancer/pituitary-tumors/treating.html
4. www.cancer.org/cancer/brain-spinal-cord-tumors-children.html

References

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Key Statistics About Pituitary Tumors

About 10,000 pituitary tumors are diagnosed each year in the United States. Almost all of these tumors are benign pituitary adenomas. Very few pituitary tumors are cancers (carcinomas).

The actual number of pituitary tumors may be much higher than the number of tumors that are found each year. When examining people who have died or who have had imaging tests (like MRI scans) of their brain for other health problems, doctors have found that as many as 1 out of 4 people may have a pituitary adenoma without knowing it. These tumors are often small and never cause any symptoms or health problems, so very few of them would normally be diagnosed at all.

Pituitary tumors can occur at any age (including in children), but they are most often found in older adults.

References

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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What's New in Pituitary Tumor Research?

Research into pituitary tumors is taking place in many university hospitals, medical centers, and other institutions around the world.

Research on pituitary tumor causes

Doctors now have a better understanding of the genetic basis of pituitary tumors. This is already leading to improvements in genetic testing for people who are suspected of having [multiple endocrine neoplasia, type 1](#)¹ (MEN1) or other syndromes. This work is also helping doctors better understand non-functioning adenomas, such as those that don't respond to somatostatin drugs, which may lead to new treatments for these tumors. This might also make it possible to identify genes and markers that could help doctors know whether a benign pituitary adenoma will likely go on to spread and become a pituitary carcinoma (cancer).

Research on tests for pituitary tumors

Imaging tests such as MRI scans continue to improve, leading to better accuracy in finding and determining the size of new tumors and those that come back after treatment. Studies are now looking at whether using MRI during surgery might help to more completely remove tumors. New scans , are also being tested in clinical trials.

Research on treating pituitary tumors

Surgical techniques are improving, allowing doctors to remove tumors with fewer complications than ever before. Studies are now looking at what's the best surgery for different types and sizes of tumors, as well as ways to combine surgical techniques or use 2-staged surgery to get better results. Robotic surgery is also being looked at as a way to reach these tumors and limit side effects. Surgery is often used to treat pituitary tumors, and doctors are looking at ways to remove the tumor, but spare as much of the pituitary gland as possible. This may mean fewer hormone issues after surgery and could give patients a better quality of life.

Radiation therapy techniques are improving as well, letting doctors focus radiation more precisely on tumors and limiting the damage to nearby normal tissues.

New ways of using radiation therapy are also being studied. For instance, doctors are using radioactive implants put right into the tumors. They're also looking at whether radiation after surgery helps keep pituitary tumors from coming back.

Progress is being made in the medicines used to treat both pituitary tumors and the side effects of some other forms of treatment. For instance, studies are looking at whether steroid treatment is really needed when surgery is done for tumors that cause a decrease in the hormone ACTH. (This can lead to low levels of the steroids your body makes and can cause serious side effects.)

Researchers are also studying some newer drugs. An example is lapatinib (Tykerb), a drug that targets a protein called HER2, which is found in large amounts on some fast-growing cells (including some pituitary tumor cells). This drug is already used to treat breast cancer, and it is now being studied for use against pituitary tumors.

Temozolomide (Temodar) is another example. It's a drug used to treat certain brain tumors. It's now being studied to see if it can help treat and improve outcomes in aggressive pituitary tumors.

Because many of the drugs used to treat these tumors must be taken for the rest of a person's life, researchers are trying to make some of these drugs into forms that are easier to use. Octreotide is a drug commonly used to treat certain pituitary tumors. It's give as a shot 3 times a day. Clinical studies are looking at whether a newly created pill form of octreotide works as well.

Many other drugs are also being studied in [clinical trials](#)².

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/causes-risks-prevention/risk-factors.html
2. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

References

Almalki MH, Aljoaib NN, Alotaibi MJ, et al. Temozolomide therapy for resistant prolactin-secreting pituitary adenomas and carcinomas: a systematic review. *Hormones*. 2017;16(2):139-149.

Biermasz NR. New medical therapies on the horizon: oral octreotide. *Pituitary*. 2017;20(1):149-153.

Chauvet D, Hans S, Missistrano A, et al. Transoral robotic surgery for sellar tumors: first clinical study. *J Neurosurg*. 2017;127(4):941-948.

Curtò L. Temozolomide therapy: Focus on patients with pituitary carcinoma. *J Neurosci Rural Pract*. 2016;7(3):335–336.

Han S, Gao W, Jing Z, Wang Y, Wu A. How to deal with giant pituitary adenomas: transsphenoidal or transcranial, simultaneous or two-staged? *J Neurooncol*. 2017;132(2):313-321.

Heaney AP. Pituitary Carcinoma: Difficult Diagnosis and Treatment. *J Clin Endocrinol Metab*. 2011;96(12):3649–3660.

Ibáñez-Costa A, Korbonits M. AIP and the somatostatin system in pituitary tumours. *J Endocrinol*. 2017;235(3):R101-R116.

Lasolle H, Cortet C, Castinetti F, et al. Temozolomide treatment can improve overall survival in aggressive pituitary tumors and pituitary carcinomas. *Eur J Endocrinol*. 2017;176(6):769-777.

Li HY, Feng CY, Zhang C, et al. Microscopic surgery for pituitary adenomas to preserve the pituitary gland and stalk. *Exp Ther Med*. 2017;13(3):1011-1016.

Swinney C, Li A, Bhatti I, Veeravagu A. Optimization of tumor resection with intra-operative magnetic resonance imaging. *J Clin Neurosci*. 2016;34:11-14.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Pituitary Tumors Causes, Risk Factors, and Prevention

Risk Factors

A risk factor is anything that affects your chance of getting a disease. Learn more about the risk factors for pituitary tumors.

- [Risk Factors for Pituitary Tumors](#)
- [What Causes Pituitary Tumors?](#)

Prevention

The risk of many types of cancer can be reduced with certain lifestyle changes (such as staying at a healthy weight or quitting smoking). But pituitary tumors have not been linked with any known outside risk factors. As a result, there is no known way to prevent these tumors at this time.

- [Can Pituitary Tumors Be Prevented?](#)
-

Risk Factors for Pituitary Tumors

A risk factor is anything that changes a person's chance of getting a disease. For example, smoking is a risk factor for cancer of the lung and many other cancers.

But having a risk factor, or even many risk factors, does not mean that you will get the disease. And many people who get the disease may have few or no known risk factors.

Pituitary tumors have very few known risk factors, and these are related to genetics. There are no known environmental or lifestyle-related risk factors for pituitary tumors. Though science has suggested that people who are overweight or obese might be at increased risk.

Family history

Most people who develop pituitary tumors don't have a family history of the disease. But rarely, pituitary tumors can run in families.

Sometimes when pituitary tumors run in families, they are found along with other types of tumors as part of an inherited genetic syndrome (see the next section).

Sometimes, though, only pituitary tumors occur. Researchers have found that some of these are due to certain changes in a person's genes that are inherited from a parent. (See [What Causes Pituitary Tumors?](#))

Most often, though, the cause of pituitary tumors that run in families is not known.

Genetic syndromes

Pituitary tumors can be a part of a syndrome that includes an increased risk of other types of tumors. These syndromes are caused by abnormal changes (mutations) in a person's genes. They include:

Multiple endocrine neoplasia, type I (MEN1): This is a hereditary condition in which people have a very high risk of developing tumors of 3 glands: the pituitary, parathyroid, and pancreas. It is caused by changes in the gene *MEN1*, and is passed on to about half of the children of an affected parent. If the MEN1 syndrome affects your family, you should discuss testing for this condition with your doctor.

Multiple endocrine neoplasia, type IV (MEN4): This rare syndrome includes increased risks of pituitary tumors and certain other tumors. MEN4 is caused by inherited changes in a gene called *CDKN1B*.

McCune-Albright syndrome: This syndrome is caused by changes in a gene called *GNAS1* that aren't inherited but occur before birth. People with this syndrome have brown patches on their skin (called *café-au-lait spots*) and develop many bone

problems. They can also have hormone problems and pituitary tumors.

Carney complex: This is a rare syndrome in which people can have heart, skin, and adrenal problems. They also have a high risk of a number of different types of tumors, including pituitary tumors. Many cases are caused by inherited changes in the gene *PRKAR1A*, but some are caused by changes in other genes that have not yet been identified.

You can learn more about inherited cancer syndromes in [Family Cancer Syndromes](#)¹.

Hyperlinks

1. www.cancer.org/cancer/cancer-causes/genetics/family-cancer-syndromes.html

References

Wiedmann MKH, Brunborg C, Di Ieva A, et al. Overweight, obesity and height as risk factors for meningioma, glioma, pituitary adenoma and nerve sheath tumor: a large population-based prospective cohort study. *Acta Oncol.* 2017;56(10):1302-1309.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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What Causes Pituitary Tumors?

Scientists don't know exactly what causes most pituitary tumors. During the past few years, they have made great progress in understanding how certain changes in a person's DNA can cause cells in the pituitary to produce a tumor. DNA is the chemical in each of our cells that makes up our *genes* – the instructions for how our cells function. We usually look like our parents because they are the source of our DNA. But DNA affects more than how we look.

Some genes control when cells grow, divide into new cells, and die. Genes that help

cells grow, divide, and stay alive are called *oncogenes*. Genes that slow down cell division or cause cells to die at the right time are called *tumor suppressor genes*. Tumors can be caused by DNA changes that turn on oncogenes or turn off tumor suppressor genes.

Some people inherit gene mutations (changes) from their parents that greatly increase their risk for developing pituitary tumors. Some of these mutations were described in [Risk Factors for Pituitary Tumors](#). Members of families with these genetic syndromes can have genetic testing to find out if they are affected.

But often, gene mutations occur during life rather than having been inherited. In some types of cancer, these *acquired* mutations can be caused by outside exposures, such as radiation or cancer-causing chemicals. Most pituitary tumors are not cancers, and there are no known environmental causes for these tumors. The gene changes in these tumors might just be random events that sometimes happen when a cell divides, without having an outside cause.

Some non-hereditary (sporadic) pituitary tumors – those that don't run in families – have acquired mutations in a gene called *AIP*. Many growth hormone-secreting adenomas have an acquired mutation in a gene called *GNAS1*. These mutations are much less common in other types of pituitary adenomas.

Changes in other genes have been found in other types of pituitary adenomas, but it's not clear if abnormal genes are always needed for pituitary tumors to form. What is known is that there is a loss of the regulatory mechanism that normally keeps the pituitary cells from growing and making too much hormone.

Because there are no known lifestyle-related or environmental causes of pituitary tumors, it's important to remember that there is nothing people with these tumors could have done to prevent them.

References

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Can Pituitary Tumors Be Prevented?

The risk of many types of cancer can be reduced with certain lifestyle changes (such as staying at a [healthy weight](#)¹ or [quitting smoking](#)²). But pituitary tumors have not been linked with any known outside risk factors. As a result, there is no known way to prevent these tumors at this time.

Still, for people at high risk of pituitary tumors (because of certain [inherited syndromes](#)), there may be ways to find and treat them early, before they cause problems. (See [Can Pituitary Tumors Be Found Early?](#)³)

Hyperlinks

1. www.cancer.org/healthy/eat-healthy-get-active.html
2. www.cancer.org/healthy/stay-away-from-tobacco.html
3. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/detection.html

References

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Pituitary Tumors Early Detection, Diagnosis, and Staging

Detection and Diagnosis

Finding a tumor early, or when it's small, might allow for more treatment options. Some early tumors may have signs and symptoms that can be noticed, but that's not always the case.

- [Can Pituitary Tumors Be Found Early?](#)
- [Signs and Symptoms of Pituitary Tumors](#)
- [Tests for Pituitary Tumors](#)

Staging

For most types of cancer, the stage (extent) of the cancer is an important part of determining treatment options. But for pituitary tumors, other factors, such as if the tumor is releasing hormones or causing symptoms, are often more important.

- [How Are Pituitary Tumors Staged?](#)

Questions to Ask About Pituitary Tumors

Here are some questions you can ask your health care team to help you better understand your diagnosis and treatment options.

- [What Should You Ask Your Doctor About Pituitary Tumors?](#)
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Can Pituitary Tumors Be Found Early?

No imaging tests or blood tests are recommended to screen for pituitary tumors in people who are not at increased risk. (Screening is testing for tumors in people without any symptoms.)

For members of families known to be at increased risk because of a [genetic syndrome](#)¹ such as multiple endocrine neoplasia, type I (MEN1), doctors often recommend regular blood testing of pituitary hormone levels. These tests increase the odds of finding a tumor early so that it can be removed completely, increasing the chance for a cure.

Rarely, a pituitary tumor is found early because a person has a CT or MRI scan of the brain for an unrelated problem. These tumors are sometimes referred to as *incidentalomas*, meaning they are found incidentally (by accident).

Functional pituitary adenomas (tumors that make excess hormones like prolactin or ACTH) are often found when they are still small because the excess hormones cause [symptoms](#).

Non-functional pituitary tumors are less likely to be found early because they don't cause symptoms until they've grown large enough to press on normal pituitary cells, nerves, or parts of the brain near the pituitary.

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/causes-risks-prevention/risk-factors.html

References

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Signs and Symptoms of Pituitary Tumors

Not all pituitary tumors (called pituitary adenomas) cause symptoms. But when they do, they can cause many different types of symptoms. The first signs of a pituitary adenoma often depend on whether the tumor is *functional* (making excess hormones) or *non-functional* (not making excess hormones).

Functional adenomas can cause problems because of the hormones they release.

Most of the time, a functional adenoma makes too much of a single pituitary hormone. These tumors are often found while they are still fairly small (microadenomas). Symptoms from functional adenomas are described below, based on which hormone they make.

Tumors that aren't making excess hormones (non-functional adenomas) often become large (macroadenomas) before they are noticed. These tumors don't cause symptoms until they press on nearby nerves, parts of the brain, or other parts of the pituitary.

Non-functional adenomas that cause no symptoms are sometimes found because of an MRI or CT scan done for other reasons. These tumors are now being found more often as more MRI and CT scans of the brain are done. These might be the most common pituitary tumors. As long as they aren't causing problems, they're often just watched closely without needing treatment.

Large tumors (macroadenomas) and pituitary carcinomas

Pituitary macroadenomas (benign tumors larger than 1 cm) and carcinomas (cancers), whether functional or not, can be large enough to press on nearby nerves or parts of the brain. This can lead to symptoms such as:

- Eye muscle weakness so the eyes don't move in the same direction at the same time
- Blurred or double vision
- Loss of peripheral vision
- Sudden blindness
- Headaches
- Facial numbness or pain

- Dizziness
- Loss of consciousness (passing out)

Vision problems occur when the tumor “pinches” the nerves that run between the eyes and the brain. Sudden loss of vision, loss of consciousness, and even death can result from sudden bleeding into the tumor.

Macroadenomas and pituitary carcinomas can also press on and destroy the normal parts of the pituitary gland. This causes a shortage of one or more pituitary hormones. Low levels of some body hormones such as cortisol, thyroid hormone, and sex hormones cause symptoms. Depending on which hormones are affected, symptoms might include:

- Nausea
- Weakness
- Unexplained weight loss or weight gain
- Loss of body hair
- Feeling cold
- Feeling tired or weak
- Menstrual changes or loss of menstrual periods in women
- Erectile dysfunction (trouble with erections) in men
- Growth of breast tissue in men
- Decreased interest in sex, mainly in men

Diabetes insipidus

Large tumors can sometimes press on the posterior (back) part of the pituitary, causing a shortage of the hormone *vasopressin* (also called *anti-diuretic hormone* or ADH). This can lead to diabetes insipidus. **In this condition, too much water is lost in the urine**, so the person urinates often and becomes very thirsty as the body tries to keep up with the loss of water. If left untreated, this can cause dehydration and altered blood mineral levels, which can lead to coma and even death. Diabetes insipidus is easily treated with a drug called desmopressin, which replaces the vasopressin. (Diabetes insipidus is not related to diabetes mellitus, in which people have high blood sugar levels.)

Growth hormone-secreting adenomas (somatotroph adenomas)

The major symptoms from these tumors are caused by having too much growth

hormone (GH). These effects are quite different in children and adults.

In children, high GH levels can stimulate the growth of nearly all bones in the body. The medical term for this condition is *gigantism*. Signs include:

- Being very tall
- Very rapid growth
- Joint pain
- Increased sweating

In adults, the long bones (especially in the arms and legs) can't grow any more, even when GH levels are very high. So they don't grow taller and develop gigantism. **But bones of an adult's hands, feet, and skull/face can grow throughout life. This causes a condition called *acromegaly*.** Signs and symptoms are:

- Growth of the skull, hands, and feet, leading to increase in hat, shoe, glove, and ring size
- Deepening of the voice
- Change in how the face looks (due to growth of facial bones)
- Wider spacing of the teeth and protruding jaw (due to jawbone growth)
- Joint pain
- Increased sweating
- High blood sugar or even diabetes mellitus
- Kidney stones
- Heart disease
- Headaches
- Vision changes
- Numbness or tingling in the hands or feet
- Thickening of tongue and roof of mouth, leading to sleep disturbances such as snoring and sleep apnea (pauses in breathing)
- Thickened skin
- Increased growth of body hair

Many of these changes can occur very slowly, and people might not notice them until they look at an old picture of themselves or try to put on a hat or ring they haven't worn in many years.

Corticotropin (ACTH)-secreting adenomas (corticotroph adenomas)

High ACTH levels cause the adrenal glands to make steroid hormones such as cortisol. Having too much of these hormones causes symptoms that doctors group together as *Cushing's syndrome*. When the cause is **too much ACTH production from the pituitary it's called *Cushing's disease***. In adults, the symptoms can include:

- Unexplained weight gain (mostly in the face, chest, and belly)
- Purple stretch marks on the chest or belly
- New or increased hair growth (on the face, chest, and/or belly)
- Swelling and redness of the face
- Acne
- Extra fat on the back of the neck
- Moodiness or depression
- Headache
- Vision changes
- Easy bruising
- High blood sugar levels or even diabetes mellitus
- High blood pressure
- Decreased interest in sex
- Changes in menstrual periods in women
- Weakening of the bones, which can lead to osteoporosis or even fractures

Most of these symptoms can also occur in children. Children with Cushing's disease may also stop growing and have problems with school performance.

Prolactin-secreting adenomas (prolactinomas or lactrotroph adenomas)

Prolactinomas are most common in young women and older men.

- In women before menopause, high prolactin levels cause menstrual periods to become less frequent or to stop. High prolactin levels can also cause abnormal breast milk production, called *galactorrhea*.
- In men, high prolactin levels can cause breast growth and erectile dysfunction (trouble with erections)
- Both men and women can have: Loss of interest in sex Infertility Weakening of the bones called osteoporosis

If the tumor continues to grow, it can press on nearby nerves and parts of the brain,

which can cause headaches and vision problems.

In females who don't have periods (such as girls before puberty and women after menopause), prolactinomas might not be noticed until they cause these symptoms.

Thyrotropin (TSH)-secreting adenomas (thyrotroph adenomas)

These rare tumors make too much thyroid-stimulating hormone (TSH), which then causes the thyroid gland to make too much thyroid hormone. This can cause symptoms of hyperthyroidism (overactive thyroid), such as:

- Rapid or irregular heartbeat
- Tremors (shaking)
- Weight loss
- Increased appetite
- Feeling warm or hot
- Sweating
- Trouble falling asleep
- Anxiety
- Frequent bowel movements
- A lump in the front of the neck (enlarged thyroid)

Gonadotropin-secreting adenomas (gonadotroph adenomas)

These rare tumors make luteinizing hormone (LH) and/or follicle-stimulating hormone (FSH). This can cause irregular menstrual periods in women or low testosterone levels and decreased interest in sex in men.

Many gonadotropin-secreting adenomas actually don't make enough hormones to cause symptoms, so they are basically non-functional adenomas. These tumors may grow large enough to cause symptoms such as headaches and vision problems before they are found. (See the symptoms for large tumors above.)

References

Molitch ME. Diagnosis and Treatment of Pituitary Adenomas: A Review. JAMA.

2017;317(5):516-524.

National Cancer Institute. Pituitary Tumors Treatment (PDQ®)—Patient Version. August 18, 2017. Accessed at www.cancer.gov/types/pituitary/patient/pituitary-treatment-pdq on October 16, 2017.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

Last Medical Review: November 2, 2017 Last Revised: November 2, 2017

Tests for Pituitary Tumors

Pituitary tumors are usually found when a person goes to the doctor because of [symptoms](#) they're having. But sometimes these tumors don't cause symptoms, and they're found when doing medical tests done for other health problems.

If there's a reason to suspect you might have a pituitary tumor, your doctor will use one or more tests to find out. Signs and symptoms might suggest that you could have a pituitary tumor, but tests are needed to be sure of the diagnosis and find out what [kind of pituitary tumor](#)¹ it is.

Medical history and physical exam

If your symptoms lead your doctor to believe that you might have a pituitary tumor, the first step is take a complete medical history to check for [risk factors](#)² and to learn more about your symptoms. Your doctor may ask about your family history of tumors or other problems to see if you might have an [inherited genetic syndrome](#)³, such as multiple endocrine neoplasia, type I (MEN1).

Your doctor will also examine you to look for possible signs of a pituitary tumor or other health problems. This may include exams to look for vision or nervous system problems that could be caused by a tumor.

If a pituitary tumor is strongly suspected, your doctor may refer you to an eye doctor to check your vision, as pituitary tumors can damage nerves leading to the eyes. The most common test is to measure how well you can see. The doctor may also test your field of

vision (or visual fields). At first, pituitary tumors only press on part of the optic nerves. This often leads to the loss of peripheral vision, meaning that you can't see things off to the side without actually looking right at them. Eye doctors have special instruments that can test for this.

You might also be referred to other doctors, such as an endocrinologist (a doctor who treats diseases in glands that secrete hormones) or a neurosurgeon (a doctor who uses surgery to treat brain and pituitary tumors), who might order other tests.

Blood and urine tests of hormone levels

If your doctor suspects you might have a hormone-producing pituitary tumor, hormone levels in your blood and/or urine will be measured.

Somatotroph (growth hormone-secreting) adenoma

A physical exam may alert the doctor to look for this tumor because the [signs and symptoms](#) are often very distinctive.

The next step is to check the levels of growth hormone and insulin-like growth factor-1 (IGF-1) in your blood samples, which are taken in the morning after an overnight fast. When growth hormone levels are high, they cause the liver to make more IGF-1. Testing the IGF-1 level can be more helpful than checking the level of growth hormone. IGF-1 level doesn't change much during the day, while the level of growth hormone can go up and down.

If both levels are very high, the diagnosis is clearly a pituitary tumor. If the levels are slightly increased, another test called a *glucose suppression test* is often done to be sure. You'll be asked to drink a sugary liquid, then the levels of growth hormone and blood sugar will be measured at certain times. The normal response to suddenly taking in so much sugar is a drop in growth hormone levels. If the growth hormone levels stay high, a pituitary adenoma is likely the cause.

Corticotroph (corticotropin or ACTH-secreting) adenoma

Most of the [signs and symptoms](#) of ACTH-secreting tumors come from having too much cortisol (an adrenal steroid hormone). But quite a few diseases can cause the body makes too much cortisol, which is called Cushing's syndrome. If you have symptoms suggesting this syndrome, you'll need tests to see if it's caused by a pituitary tumor or something else.

One of the tests used measures the levels of cortisol in your saliva late at night to see if they stay elevated. (They normally drop at night.) Another may include measuring levels of cortisol and ACTH in blood samples taken at different times of the day. You also may be asked to collect all of your urine over a 24-hour period, which is then tested to measure your daily production of cortisol and other steroid hormones. One test involves taking a dose of a powerful, cortisone-like drug called dexamethasone, then checking blood or urine cortisol levels. Often more than 1 of these tests is needed to help distinguish ACTH-secreting pituitary tumors from other diseases, such as adrenal gland tumors, that can cause similar symptoms.

Lactotroph (prolactin-secreting) adenoma (also called a prolactinoma)

Blood prolactin levels can be measured to check for a prolactinoma.

Gonadotroph (gonadotropin-secreting) adenoma

Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) blood levels can be checked to see if you have a gonadotropin-secreting tumor. Levels of related hormones, such as estrogen, progesterone, and testosterone, are often checked as well.

Thyrotroph (thyrotropin-secreting) adenoma

Tests to measure blood levels of thyrotropin (TSH) and thyroid hormones can usually identify people with a thyrotropin-secreting adenoma.

Null cell (non-functional) adenoma

A pituitary adenoma is considered non-functional if it doesn't make too much of any pituitary hormone. Pituitary hormone levels are not high in people with non-functional tumors. Sometimes, though, blood levels of pituitary hormones may actually be low because the adenoma crowds out the cells that normally make these hormones.

Testing for diabetes insipidus

Diabetes insipidus can occur if the part of the pituitary that stores the hormone vasopressin (ADH) is damaged, which leads to too much water being lost in the urine. This condition can be caused by pituitary macroadenomas (or carcinomas in rare cases), or by tumors starting in parts of the brain or nerves next to the pituitary gland. It can also be a side effect of [surgery to treat pituitary tumors](#)⁴ or tumors near the pituitary gland.

In many cases, this diagnosis is made with tests that measure the amount of urine made over a 24-hour period, sodium and glucose levels in the blood, and *osmolality* (total salt concentration) of the blood and urine. If these test results are not clear, then a water deprivation study may be done. In this test, you are not allowed to drink fluids for several hours. The test is often done overnight. If your body is not making enough vasopressin, you'll continue to make urine even though you are not taking in any fluid. You may also be given an injection of vasopressin to see if this corrects the problem.

Venous blood sampling

Corticotroph (ACTH-secreting) adenomas may be too small to be seen on imaging tests such as [MRI scans](#)⁵. When the ACTH level is high, but a person's MRI is normal, a special blood test may be useful to find the tumor.

For this test, catheters (long, soft, small tubes) are put into veins on each inner thigh through tiny cuts in the skin and are guided all the way up into the petrosal sinuses near the base of the brain. The sinuses hold 2 small veins that drain the blood from each side of the pituitary gland. Blood is taken from these 2 veins and your arm. Then an injection of corticotropin-releasing hormone (CRH, a hormone from the hypothalamus that normally causes the pituitary to make ACTH) is given. Blood samples are taken again to see if the ACTH level goes up a lot, or is higher on one side than the other. If it is, the source of the high ACTH level is a pituitary tumor.

Imaging tests

[Imaging tests](#)⁶ use x-rays, magnetic fields, or other means to create pictures of the inside of your body. They may be done to look for pituitary tumors or to see if they have grown into nearby structures. In some cases, an imaging test of the head done for another reason may show a pituitary tumor.

Magnetic resonance imaging (MRI) scan

[MRI scans](#)⁷ use radio waves and strong magnets to create detailed pictures of the inside of the body.

They are very helpful in looking at the brain and spinal cord and are considered to be the best way to find pituitary tumors of all types. MRI images are usually more detailed than those from CT scans (see below). They can show macroadenomas of the pituitary gland, as well as most microadenomas. But MRI might not detect microadenomas that are smaller than 3 mm (about 1/8 inch) across. Sometimes the MRI scan will show a

small change in the pituitary that has nothing to do with the patient's symptoms. Between 5% and 25% of healthy people have some minor abnormality of the pituitary gland that shows up on an MRI scan.

Computed tomography (CT) scan

A [CT scan](#)⁸ uses x-rays to create detailed cross-sectional images of part of your body. CT scans can find a pituitary adenoma if it's large enough, but MRI scans are used much more often to look at the brain and pituitary gland.

Tests of pituitary tissue samples

In diagnosing tumors of most parts of the body, imaging tests and blood tests may strongly suggest a certain type of tumor, but a [biopsy](#)⁹ (removing a sample of the tumor to examine under a microscope) is usually the only way to be certain of the diagnosis. In many cases, doctors won't treat a tumor until a biopsy has been done.

But a biopsy isn't usually needed before treating a pituitary tumor. One reason is that the hormone tests for some types of adenomas are very accurate, so a biopsy isn't likely to provide much more information. Biopsies in this part of the body can also pose a very small risk of serious side effects. On top of this, some types of adenomas can be treated without surgery, using [medicines](#)¹⁰ or [radiation therapy](#)¹¹.

When pituitary tumors are [removed by surgery](#)¹², they're examined under a microscope to determine their exact type. Special stains may be used on the tumor to color the areas making hormones and [other tests](#)¹³ may be done, too. This helps classify the tumor.

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/about/what-is-pituitary-tumor.html
2. www.cancer.org/cancer/pituitary-tumors/causes-risks-prevention/risk-factors.html
3. www.cancer.org/cancer/pituitary-tumors/causes-risks-prevention/risk-factors.html
4. www.cancer.org/cancer/pituitary-tumors/treating/surgery.html
5. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
6. www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html
7. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
8. www.cancer.org/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html

9. www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html
10. www.cancer.org/cancer/pituitary-tumors/treating/medicines.html
11. www.cancer.org/cancer/pituitary-tumors/treating/radiation-therapy.html
12. www.cancer.org/cancer/pituitary-tumors/treating/surgery.html
13. www.cancer.org/treatment/understanding-your-diagnosis/tests/testing-biopsy-and-cytology-specimens-for-cancer.html

References

Mercado M, Melgar V, Salame L, Cuenca D. Clinically non-functioning pituitary adenomas: Pathogenic, diagnostic and therapeutic aspects. *Endocrinol Diabetes Nutr.* 2017;64(7):384-395.

Molitch ME. Diagnosis and Treatment of Pituitary Adenomas: A Review. *JAMA.* 2017;317(5):516-524.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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How Are Pituitary Tumors Staged?

Staging is the process of determining how far a cancer has spread. This is done to guide [treatment](#)¹ and to help determine the most likely outcome for the patient. But pituitary tumors are nearly always benign (not cancer), so there is no staging system for them. Pituitary carcinoma (cancer) is too rare for a staging system to have been developed.

The most useful information for guiding the treatment of a pituitary adenoma is:

- Whether it is a microadenoma (smaller than 1 centimeter across) or macroadenoma (1 centimeter across or larger)
- Whether it has grown into nearby structures (such as bones of the skull)

- Whether it is causing symptoms such as vision changes
- Whether it is functional (making excess hormones) or non-functional
- Which hormone it releases

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/treating.html

References

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

Last Medical Review: May 8, 2014 Last Revised: December 17, 2014

What Should You Ask Your Doctor About Pituitary Tumors?

As you deal with your tumor and its treatment, you need to have honest, open discussions with your health care team. Feel free to ask any question, no matter how small it might seem. Here are some questions you might want to ask. Be sure to add your own questions as you think of them. Nurses, social workers, and other members of the treatment team may also be able to answer many of your questions.

- Is my tumor benign or malignant? How certain is the diagnosis?
- Has my tumor spread into the nearby brain tissue or other structures?
- Is my tumor secreting excess amounts of hormone? If so, which one?
- Do I need other ¹[tests](#) before we can decide on treatment?
- Do I need to see other doctors?
- How much experience do you have treating this type of tumor?
- Should I get a [second opinion](#)²? Can you recommend a doctor or hospital?
- What are my [treatment choices](#)³? What do you recommend? Why?
- What is the goal of treatment (cure, keeping the tumor in check, etc.)?

- Is treatment needed right away?
- What are the possible risks or side effects of treatment?
- Will this treatment affect my ability to have children?
- What should I do to be ready for treatment?
- How long will treatment take? What will it be like? Where will it be given?
- What is my expected prognosis (outlook), based on my tumor as you view it?
- What would we do if the treatment doesn't work or if the tumor comes back?
- What type of ⁴[follow-up](#)⁵ will I need after treatment?

Along with these sample questions, be sure to write down any others you want to ask. For instance, you might want information about recovery times so that you can plan your work and activity schedule. Or you may want to ask about [clinical trials](#)⁶ for which you may qualify.

Hyperlinks

1. www.cancer.org/treatment/finding-and-paying-for-treatment/choosing-your-treatment-team/seeking-a-second-opinion.html
2. www.cancer.org/cancer/pituitary-tumors/treating.html
3. www.cancer.org/cancer/pituitary-tumors/after-treatment/follow-up.html
4. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

References

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Treating Pituitary Tumors

How are pituitary tumors treated?

Treatment for pituitary tumors may include:

- [Surgery for Pituitary Tumors](#)
- [Radiation Therapy for Pituitary Tumors](#)
- [Medicines to Treat Pituitary Tumors](#)

Common treatment approaches

Sometimes a combination of treatments is used. For example, surgery may be done to remove some of the tumor, while drugs can be used to relieve symptoms and sometimes shrink the remaining tumor. Common treatment plans differ by tumor type.

- [Treatment of Functional \(Hormone-Making\) Pituitary Tumors](#)
- [Treatment of Non-Functional Pituitary Tumors \(Tumors That Don't Make Excess Hormones\)](#)
- [Treatment of Pituitary Carcinomas](#)

Who treats pituitary tumors?

Pituitary tumors often require care from a team of doctors. Doctors on your team may include:

- **Neurosurgeon:** a doctor who uses surgery to treat brain and pituitary tumors
- **Endocrinologist:** a doctor who treats diseases in glands that make hormones
- **Neurologist:** a doctor who diagnoses and treats brain and nervous system diseases

- **Radiation oncologist:** a doctor who uses radiation to treat cancers and other tumors
- **Medical oncologist:** a doctor who uses chemotherapy and other medicines to treat cancers and other tumors

Many other specialists might be part of your treatment team as well, including physician assistants, nurse practitioners, nurses, psychologists, social workers, rehabilitation specialists, and other health professionals.

- [Health Professionals Associated With Cancer Care¹](#)

Making treatment decisions

Your doctor will discuss treatment options with you. It's important to take time and think about your choices, weighing the benefits of each option against the possible risks and side effects. It's also important to ask questions if there's anything you're not sure about.

Because pituitary tumors are rare, not many doctors have much experience with them. You may want to get a second opinion. This can give you more information and help you feel more certain about the treatment plan you choose. Many people find it helpful to get a second opinion about the best treatment options based on their situation, especially if they have several choices.

- [What Should You Ask Your Doctor About Pituitary Tumors?²](#)
- [Seeking a Second Opinion³](#)

Thinking about taking part in a clinical trial

Clinical trials are carefully controlled research studies that are done to get a closer look at promising new treatments or procedures. Clinical trials are one way to get state-of-the-art cancer treatment. In some cases they may be the only way to get access to newer treatments. They are also the best way for doctors to learn better methods to treat cancer. Still, they're not right for everyone.

If you would like to learn more about clinical trials that might be right for you, start by asking your doctor if your clinic or hospital conducts clinical trials.

- [Clinical Trials⁴](#)

Considering complementary and alternative methods

You may hear about alternative or complementary methods that your doctor hasn't mentioned to treat your cancer or relieve symptoms. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

Complementary methods refer to treatments that are used along with your regular medical care. Alternative treatments are used instead of a doctor's medical treatment. Although some of these methods might be helpful in relieving symptoms or helping you feel better, many have not been proven to work. Some might even be harmful.

Be sure to talk to your cancer care team about any method you are thinking about using. They can help you learn what is known (or not known) about the method, which can help you make an informed decision.

- [Complementary and Alternative Medicine](#)⁵

Help getting through cancer treatment

Your cancer care team will be your first source of information and support, but there are other resources for help when you need it. Hospital- or clinic-based support services are an important part of your care. These might include nursing or social work services, financial aid, nutritional advice, rehab, or spiritual help.

The American Cancer Society also has programs and services – including rides to treatment, lodging, and more – to help you get through treatment. Call our National Cancer Information Center at 1-800-227-2345 and speak with one of our trained specialists.

- [Find Support Programs and Services in Your Area](#)⁶

Choosing to stop treatment or choosing no treatment at all

For some people, when treatments have been tried and are no longer controlling the cancer, it could be time to weigh the benefits and risks of continuing to try new treatments. Whether or not you continue treatment, there are still things you can do to help maintain or improve your quality of life.

Some people, especially if the cancer is advanced, might not want to be treated at all. There are many reasons you might decide not to get cancer treatment, but it's important

to talk to your doctors and you make that decision. Remember that even if you choose not to treat the cancer, you can still get supportive care to help with pain or other symptoms.

- [If Cancer Treatments Stop Working](#)⁷
- [Palliative or Supportive Care](#)⁸

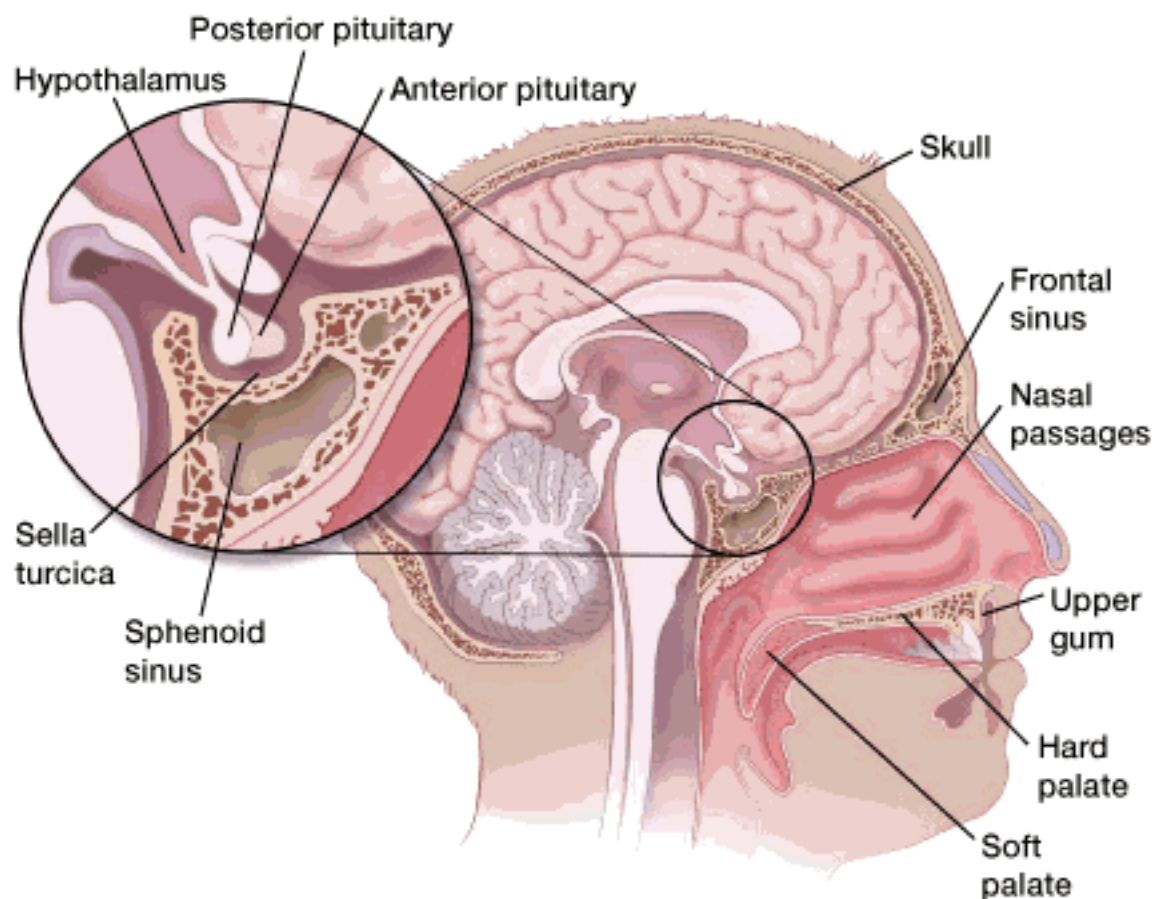
The treatment information given here is not official policy of the American Cancer Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor. Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

Surgery for Pituitary Tumors

The main treatment for many pituitary tumors is surgery. How well the surgery works depends on the type of tumor, its exact location, its size, and whether it has spread into nearby structures.

Transsphenoidal surgery

This is the most common way to remove pituitary tumors. Transsphenoidal means that the surgery is done through the sphenoid sinus, a hollow space in the skull behind the nasal passages and below the brain. The back wall of the sinus covers the pituitary gland.



To do this surgery, the neurosurgeon makes a small incision (cut) along the nasal septum (the cartilage between the 2 sides of the nose) or under the upper lip (above the teeth). To reach the pituitary, the surgeon opens the bony walls of the sphenoid sinus with small surgical chisels, drills, or other instruments depending on the thickness of the bone and sinus. Small tools and a microscope are used to remove the tumor.

Another approach is to use an endoscope, a thin fiber-optic tube with a tiny camera at the tip. This way, the incision under the upper lip or along the nasal septum isn't needed, because the endoscope allows the surgeon to see through a small incision that's made in the back of the nasal septum. The surgeon passes instruments through the nose and opens the sphenoid sinus to reach the pituitary gland and take out the tumor. Whether this technique can be used depends on the tumor's position and the shape of the sphenoid sinus.

The transsphenoidal approach has many advantages. First, no part of the brain is touched during the surgery, so the chance of damaging the brain is very low. There may be fewer side effects, and there's also no visible scar. But this surgery may take longer, and it's hard to take out large tumors this way.

When this surgery is done by an experienced neurosurgeon and the tumor is small (a microadenoma), the cure rates are high (greater than 80%). If the tumor is large or has grown into the nearby structures (such as nerves, brain tissue, or the tissues covering the brain) the chances for a cure are lower and the chance of damaging nearby brain tissue, nerves, and blood vessels is higher.

Craniotomy

For larger or more complicated pituitary tumors, a craniotomy may be needed. In this approach the surgeon operates through an opening in the front of the skull, off to one side. The surgeon has to work carefully beneath and between the lobes of the brain to reach the tumor. Craniotomy has a higher chance of brain injury and other side effects than transsphenoidal surgery for small lesions, but it's actually safer for large and complex lesions because the surgeon is better able to see and reach the tumor as well as nearby nerves and blood vessels.

Planning surgery

For both transsphenoidal surgery and craniotomies, the doctor may use image-guidance with MRI or CT scans before surgery to learn as much as they can about the tumor. It's important to know how big the tumor is and whether it has spread beyond the pituitary gland to plan the best surgical approach and predict how likely it is that they will be able to take out all of the tumor.

In rare cases, both types of surgery are used at the same time to try to completely remove large tumors that have spread into nearby tissues.

As a general rule, smaller pituitary tumors are easier to treat with surgery. The larger and more invasive the tumor, the less likely the tumor can be cured by surgery. Side effects also tend to be more likely after surgery to remove large, invasive tumors.

Possible side effects of surgery

Surgery on the pituitary gland is a serious operation, and surgeons are very careful to try to limit any problems either during or after surgery. Complications during or after surgery such as bleeding, infections, or reactions to anesthesia (the drugs used to make you sleep during surgery) are rare, but they can happen.

Most people who have transsphenoidal surgery will have a sinus headache and congestion for up to a week or 2 after surgery.

If surgery causes damage to large arteries, to nearby brain tissue, or to nerves near the pituitary, it can lead to brain damage, a stroke, or blindness, but this is quite rare.

When doctors use the transsphenoidal approach to operate on the pituitary gland, they create a temporary pathway between the nasal sinuses and airways and the brain. Until this heals, a person can get meningitis, infection and inflammation of the meninges (the thin protective layers covering the brain). Damage to the meninges can also lead to leakage of cerebrospinal fluid (CSF, the fluid that bathes and cushions the brain) out of the nose. Whether this happens seems to depend to the size and type of tumor.

Diabetes insipidus (see [Signs and Symptoms of Pituitary Tumors](#)¹) may occur right after surgery, but it usually improves on its own within a few weeks after surgery.

Damage to the rest of the pituitary can lead to other symptoms from a lack of pituitary hormones. This is rare after surgery for small tumors, but it may be unavoidable when treating some larger macroadenomas. If pituitary hormone levels are low after surgery, this can be treated with medicine to replace certain hormones normally made by the pituitary and other glands.

You will be closely watched and your blood will be checked often as your body adjusts to normal hormone levels. If diabetes insipidus doesn't get better, it may need to be treated with a desmopressin nasal spray. If vitamin and/or mineral levels change, you may need supplements for a while. For instance, potassium levels often drop, so you may need to get it intravenously (IV, or in a vein) right after surgery.

Complications are rare after pituitary surgery, but they can be serious. Talk to your doctor about what you should watch for and what you should do if you have any problems.

For more general information about surgery as a treatment for tumors, see [Cancer Surgery](#)².

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
2. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery.html

References

Alzhrani G, Sivakumar W, Park MS, Taussky P, Couldwell WT. Delayed Complications After Transsphenoidal Surgery for Pituitary Adenomas. *World Neurosurg.* 2017; Oct 5.

Graillon T, Castinetti F, Fuentes S, et al. Transcranial approach in giant pituitary adenomas: results and outcome in a modern series. *J Neurosurg Sci.* 2017 Jan 12.

Guo-Dong H, Tao J, Ji-Hu Y, et al. Endoscopic Versus Microscopic Transsphenoidal Surgery for Pituitary Tumors. *J Craniofac Surg.* 2016;27(7):e648-e655.

Han S, Gao W, Jing Z, Wang Y, Wu A. How to deal with giant pituitary adenomas: transsphenoidal or transcranial, simultaneous or two-staged? *J Neurooncol.* 2017;132(2):313-321.

Han Y, Jiang ZQ, Zheng XL, et al. Curative effect analysis of two surgical methods for removal of pituitary adenoma via endonasal transsphenoidal approach. *Zhonghua Yi Xue Za Zhi.* 2017;97(19):1479-1483.

Kuo JS, Barkhoudarian G, Farrell CJ, et al. Congress of Neurological Surgeons (CNS) and the AANS/CNS Tumor Section. Guidelines Management Patients Non Functioning Pituitary Adenomas. *Surgical Techniques and Technologies for the Management of Patients with Nonfunctioning Pituitary Adenomas.* 2016. Accessed at www.cns.org/guidelines/guidelines-management-patients-non-functioning-pituitary-adenomas/Chapter_6 on October 13, 2017.

Li A, Liu W, Cao P, et al. Endoscopic Versus Microscopic Transsphenoidal Surgery in the Treatment of Pituitary Adenoma: A Systematic Review and Meta-Analysis. *World Neurosurg.* 2017;101:236-246.

Prete A, Corsello SM, Salvatori R. Current best practice in the management of patients after pituitary surgery. *Ther Adv Endocrinol Metab.* 2017;8(3):33-48.

Sanmillán JL, Torres-Diaz A, Sanchez-Fernández JJ, et al. Radiological Predictors for Extent of Resection in Pituitary Adenoma Surgery. A Single-center study. *World Neurosurg.* 2017 Sep 9.

You L, Li W, Chen T, et al. A retrospective analysis of postoperative hypokalemia in pituitary adenomas after transsphenoidal surgery. *PeerJ.* 2017;5:e3337.

Zhou Q, Yang Z, Wang X, et al. Risk Factors and Management of Intraoperative Cerebrospinal Fluid Leaks in Endoscopic Treatment of Pituitary Adenoma: Analysis of 492 Patients. *World Neurosurg.* 2017;101:390-395.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Radiation Therapy for Pituitary Tumors

Radiation therapy uses high energy x-rays or particle waves to kill tumor cells. This type of treatment is given by a doctor called a *radiation oncologist*. Radiation is directed at the tumor from a source outside the body.

Radiation therapy may be recommended if [surgery](#) isn't an option, if some of a pituitary tumor remains or comes back after surgery, or if the tumor causes symptoms that aren't controlled with medicines.

Radiation therapy is much like getting an x-ray, but the doses of radiation used are much higher. Before your treatments start, the radiation team will get [imaging tests](#)¹ such as [MRI scans](#)² to define the exact location, size, and shape of the tumor. This is used to determine the correct angles for aiming the radiation beams, the shape of the beams, and the proper dose of radiation.

Standard radiation is usually given in a series of treatments 5 times a week over 4 to 6 weeks. At each session, you lie on a special table while a machine delivers the radiation from precise angles. The treatment doesn't hurt. Each session lasts about 15 to 30 minutes. Much of that time is spent making sure you are in the right position so the radiation is aimed correctly. The actual time you're getting the treatment is much shorter.

Radiation can work well, but it has some drawbacks:

- It works slowly, so it can take months or even years before the tumor growth and/or excess hormone production is fully controlled.
- It can damage the remaining normal pituitary. In many cases, normal pituitary function will be lost over time, so treatment with hormones will be needed.
- It may damage some normal brain tissue, particularly near the pituitary gland, which could affect mental function years later.

- The optic nerves may be damaged, causing vision changes.
- The radiation may increase the risk of developing a brain tumor later in life, but this risk is low in adults.

Newer radiation therapy techniques

Newer techniques help lower the risks of radiation therapy. These techniques focus the radiation more precisely on the pituitary. However, some of these techniques might not be possible for some tumors that are very close to the optic nerves.

Intensity modulated radiation therapy (IMRT)

IMRT is an advanced form of 3-D radiation therapy. It uses a computer-driven machine that moves around the patient as it sends out the radiation. IMRT lets the doctor shape the radiation beams and aim them at the tumor from many angles. The intensity (strength) of the beams can also be adjusted to limit the dose reaching nearby normal tissues. This may mean fewer side effects. Many major hospitals and cancer centers now use IMRT.

Stereotactic radiosurgery/stereotactic radiation therapy

This type of treatment delivers a large, precise radiation dose to the tumor area in one treatment. Though this is called radiosurgery, no cutting or surgery is involved. In some cases, the treatment might be done in a few sessions (called stereotactic radiotherapy). Radiosurgery targets the tumor more precisely than standard radiation, causing less harm to the normal pituitary gland and limiting radiation exposure to the rest of the brain.

For this treatment, a lightweight metal frame is often attached to the head with small pins or screws to help hold the head still and aim the radiation beams very precisely. (The areas on the scalp where the frame is attached are numbed first.) Sometimes a mesh face mask is used to hold the head in place instead of a frame. Once the exact location of the tumor is known from [CT](#)³ or [MRI](#)⁴ scans, radiation is focused at the tumor from many different angles. This can be done in 2 ways:

- Thin radiation beams from a machine are focused at the tumor from hundreds of different angles for a short period of time. Each beam alone is weak, but they all converge at the tumor to give a higher dose of radiation. An example of such a machine is the *Gamma Knife*.

- A movable linear accelerator (a machine that creates radiation) that's controlled by a computer is used. Instead of delivering many beams at once, this machine moves around the head to deliver radiation to the tumor from different angles. Several machines do stereotactic radiosurgery in this way, with names such as *X-Knife*, *CyberKnife*, and *Clinac*.

Stereotactic radiosurgery typically delivers the whole radiation dose in one session, though it may be repeated if needed. Sometimes doctors give the radiation in several treatments to deliver the same or a slightly higher dose. This is called *fractionated radiosurgery* or *stereotactic radiotherapy*.

The benefits of stereotactic radiation are usually seen a bit sooner than with other forms of radiation therapy, but it can still take months to be fully effective.

Unfortunately, this therapy can't be used for tumors that are very close to the optic nerves. It also might not be helpful for tumors that have an unusual shape.

Proton beam radiation therapy

This form of treatment uses a beam of protons rather than x-rays to kill cancer cells. Protons are positive parts of atoms.

X-rays release their energy both before and after they hit their target, which can damage nearby healthy tissues and the tissues they pass through to reach the tumor. Protons, on the other hand, cause little damage to tissues they pass through and only release their energy after traveling a certain distance. Doctors can use this property to deliver more radiation to the tumor with less damage to normal tissues. Like stereotactic radiation, it has the advantage of focusing the radiation more precisely on the pituitary tumor.

But proton beam radiation therapy requires highly specialized equipment and isn't widely available – there are only a handful of proton beam centers in the United States at this time. It's not a standard treatment for pituitary tumors. Studies are still needed to see if it's safer or more effective than stereotactic radiosurgery or stereotactic radiotherapy.

More information about radiation therapy

To learn more about how radiation is used to treat tumors, see [Radiation Therapy](#)⁵.

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html
2. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
3. www.cancer.org/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html
4. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
5. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation.html

References

Burman P, van Beek AP, Biller BM, Camacho-Hübner C, Mattsson AF. Radiotherapy, Especially at Young Age, Increases the Risk for De Novo Brain Tumors in Patients Treated for Pituitary/Sellar Lesions. *J Clin Endocrinol Metab.* 2017;102(3):1051-1058.

Cohen-Inbar. Radiosurgery for pituitary adenomas. *Harefuah.* 2017;156(1):45-50.

Lee CC, Kano H, Yang HC, et al. Initial Gamma Knife radiosurgery for nonfunctioning pituitary adenomas. *J Neurosurg.* 2014;120(3):647-654.

Li X, Li Y, Cao Y, et al. Safety and efficacy of fractionated stereotactic radiotherapy and stereotactic radiosurgery for treatment of pituitary adenomas: A systematic review and meta-analysis. *J Neurol Sci.* 2017;372:110-116.

Sheehan J, Lee CC, Bodach ME, et al. Congress of Neurological Surgeons (CNS) and the AANS/CNS Tumor Section. Guidelines Management Patients Non Functioning Pituitary Adenomas. *Management of Patients with Residual or Recurrent Nonfunctioning Pituitary Adenomas.* 2016. Accessed at www.cns.org/guidelines/guidelines-management-patients-non-functioning-pituitary-adenomas/Chapter_7 on October 16, 2017.

van Westrhenen A, Muskens IS, Verhoeff JJC, Smith TRS, Broekman MLD. Ischemic stroke after radiation therapy for pituitary adenomas: a systematic review. *J Neurooncol.* 2017 Jun 28.

Yamanaka R, Abe E, Sato T, Hayano A, Takashima Y. Secondary Intracranial Tumors Following Radiotherapy for Pituitary Adenomas: *A Systematic Review. Cancers (Basel)*. 2017;9(8).

Zibar Tomši K, Dušek T, Kraljevi I, et al. Hypopituitarism after gamma knife radiosurgery for pituitary adenoma. *Endocr Res*. 2017;24:1-7.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Medicines to Treat Pituitary Tumors

Many medicines can be used to treat pituitary tumors.

Drugs for lactotroph adenomas or prolactin-secreting tumors (prolactinomas)

Drugs called *dopamine agonists* can stop prolactinomas from making too much prolactin and shrink these tumors. Drugs are often the only treatment needed. Cabergoline (Dostinex[®]) and bromocriptine (Parlodel[®]) are most commonly used. Both drugs work well, but cabergoline seems to work better and this drug stays in the body longer than bromocriptine, so it can be taken once or twice a week instead of every day.

Most people with prolactinomas can control their prolactin levels with these medicines. The drugs also shrink almost all prolactin-secreting macroadenomas. In fact, these drugs work so well that surgery usually isn't needed for prolactinomas. Even if the tumor doesn't shrink, these drugs often can keep prolactinomas from growing larger. If successful, the drug treatment may be continued for life. It's rare that prolactinomas become resistant to these drugs.

Possible side effects of these drugs include drowsiness, dizziness, nausea, vomiting, diarrhea or constipation, headaches, confusion, and depression. For women whose high prolactin levels had been causing infertility, these drugs may restore fertility.

Cabergoline may cause fewer side effects than bromocriptine.

Drugs for somatotroph adenomas or growth hormone-secreting tumors

These tumors can cause acromegaly in adults and gigantism in children. (See [Signs and Symptoms of Pituitary Tumors](#).¹) Medicines do not work well for these tumors, so they're not usually the first treatment used ([surgery](#)).

Somatostatin analogs: Drugs like octreotide (Sandostatin[®]), lanreotide (Somatuline[®] Depot), and pasireotide (Signifor[®] LAR) are man-made forms of the natural hormone somatostatin. Somatostatin, which is made in the pituitary and other glands, blocks growth hormone (somatotropin) production by adenomas. These somatostatin-like drugs can return insulin-like growth factor-1 (IGF-1) to normal levels in about 2 out of 3 patients.

Octreotide is first given as an injection under the skin 3 times per day. A longer acting form is available, which can be given as a monthly injection. Lanreotide and pasireotide are given as an injection about once a month. They may be tried if the octreotide isn't working well. Doctors measure how well these drugs are working by testing blood growth hormone and IGF-1 levels. Tumors tend to shrink very slowly with these drugs.

These drugs can have side effects, such as a slowed heart rate, nausea, vomiting, diarrhea, gas, stomach pain, dizziness, headache, and pain at the site of injection. Many of these side effects improve or even go away with time. They can also cause gallstones, and pasireotide may cause diabetes or worsen it if a person already has it.

Growth hormone antagonists: Pegvisomant (Somavert[®]) is a newer drug that works by blocking the action of growth hormone on other cells. It's very effective in lowering blood IGF-1 levels, but it doesn't block growth hormone secretion by the pituitary gland or shrink pituitary tumors. It has few side effects, but it can lower blood sugar levels and cause mild liver damage in some people. It's given by daily injection under the skin to start, but over time may be given less often, such as once a week. It can be used alone or given along with cabergoline or a somatostatin analog.

Dopamine agonists: Drugs like cabergoline or bromocriptine can reduce growth hormone levels in about 1 out of 3 patients. But higher doses are needed for these tumors than for prolactinomas, and some patients have trouble with the side effects they can cause (discussed above). An advantage of these drugs is that they can be taken as a pill.

Drugs for corticotroph adenomas or corticotropin (ACTH)-secreting tumors

These tumors cause the adrenal glands to make excess steroid hormones such as cortisol, which leads to Cushing's disease (discussed in [Signs and Symptoms of Pituitary Tumors²](#)). [Surgery](#) is the preferred treatment. Medicines are not usually part of treatment for these tumors unless surgery and [radiation](#) therapy don't work. (Or if the effects of radiation haven't happened yet. It can take 2 to 5 years to know if radiation worked.)

Many different kinds of drugs can be used, but medicines don't always work as well in ACTH-secreting tumors as they do in some other types of pituitary tumors.

- Pasireotide (Signifor[®]) is a somatostatin analog. It can help some people who have Cushing's disease from ACTH-secreting tumors when surgery is not an option or has not worked. Along with side effects such as nausea, vomiting, and diarrhea, this drug can cause high blood sugar levels and gallstones.
- Cyproheptadine (Periactin[®]) is an antihistamine drug that can suppress ACTH production in some of these tumors.
- Drugs called *steroidogenesis inhibitors* can be used to keep the adrenal gland from making cortisol, but they don't affect the pituitary tumor itself. These include ketoconazole, aminoglutethimide, etomidate, metyrapone, and mitotane. These drugs can sometimes be helpful after surgery or radiation (or if surgery is not an option), but they can be hard to take because of side effects.
- Mifepristone (Korlym[®]) is a type of drug called a *cortisol receptor blocker*. It limits the effects of cortisol on other tissues in the body. This drug can help treat high blood sugar levels in people with Cushing's disease, but it doesn't affect the pituitary tumor itself. It can have serious side effects and requires close monitoring.
- Dopamine agonists such as cabergoline or bromocriptine can also be tried if other drugs don't work.

Drugs for thyrotroph adenomas or thyrotropin (TSH)-secreting tumors

The first treatment for these rare tumors is surgery. If this doesn't cure the patient, somatostatin analogs such as octreotide and lanreotide can usually reduce the amount of TSH that's produced and may help shrink the tumor. In fact, in some cases, these drugs may be used to normalize thyroid hormone levels and shrink the tumor before surgery is done.

Dopamine agonists such as cabergoline or bromocriptine can also be used. These drugs are discussed in more detail above.

Drugs for null cell adenomas or tumors that do not make hormones

Even though these tumors don't make hormones, drugs may be used to treat them. [Surgery](#) and [radiation](#) are usually done first.

Dopamine agonists and somatostatin analogs have been found to help slow or decrease growth in some of these tumors. These are discussed above in the lactotroph and somatotroph drug sections.

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
2. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html

References

Auriemma RS, Grasso LF, Pivonello R, Colao A. The safety of treatments for prolactinomas. *Expert Opin Drug Saf*. 2016;15(4):503-12.

Drake WM, Stiles CE, Bevan JS, et al. A Follow-Up Study of the Prevalence of Valvular Heart Abnormalities in Hyperprolactinemic Patients Treated With Cabergoline. *J Clin Endocrinol Metab*. 2016;101(11):4189-4194.

Drake WM, Stiles CE, Howlett TA, et al. A cross-sectional study of the prevalence of cardiac valvular abnormalities in hyperprolactinemic patients treated with ergot-derived dopamine agonists. *J Clin Endocrinol Metab*. 2014;99(1):90-6.

Langlois F, McCartney S, Fleseriu M. Recent Progress in the Medical Therapy of Pituitary Tumors. *Endocrinol Metab (Seoul)*. 2017;32(2):162-170.

Mayson SE. Silent pituitary adenomas. *Endocrinol Metab Clin North Am*. 2015;44(1):79-87.

Molitch ME. Diagnosis and Treatment of Pituitary Adenomas: A Review. *JAMA*.

2017;317(5):516-524.

Tirosh A, Shimon I. Current approach to treatments for prolactinomas. *Minerva Endocrinol.* 2016;41(3):316-23.

Vroonen L, Lancellotti P, Garcia MT, et al. Prospective, long-term study of the effect of cabergoline on valvular status in patients with prolactinoma and idiopathic hyperprolactinemia. *Endocrine.* 2017;55(1):239-245.

Yang C, Wu H, Wang J, et al. Successful management of octreotide-insensitive thyrotropin-secreting pituitary adenoma with bromocriptine and surgery: A case report and literature review. *Medicine (Baltimore).* 2017;96(36):e8017.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Treatment of Functional (Hormone-Making) Pituitary Tumors

The treatment of functional pituitary tumors depends on which type of hormone they make.

Treatment of lactotroph adenomas or prolactin-secreting adenomas (prolactinomas)

Unlike most other pituitary tumors, surgery is usually not the first treatment for these tumors. Sometimes these tumors can just be watched and nothing needs to be done right away. Blood prolactin levels are checked regularly. If they start to go up, an [MRI](#)¹ can be done to look for an increase in tumor size. Treatment can then be started as needed.

Medicines that block the production of prolactin (like cabergoline or bromocriptine) are used first. (See [Medicines to Treat Pituitary Tumors](#).) They usually work so well that

surgery isn't needed.

These drugs also shrink most prolactin-secreting macroadenomas. Even when the tumors don't shrink, these drugs often keep them from getting bigger.

Within 3 months of starting drug treatment, the blood prolactin level is measured again and an MRI scan of the pituitary is done to see if the medicine is working. If so, treatment may be continued for the rest of the patient's life. For some people, if treatment with these medicines has worked and over time, MRI scans show no tumor, the treatment may be stopped. These people will need to have regular MRIs to see if the tumor comes back. On the other hand, if after 6 months the tumor hasn't responded well enough, or if serious side effects occur, then surgery is considered.

Some doctors recommend [surgery](#) in special cases, such as for people who cannot tolerate the drugs, or for women who want to become pregnant. (The drugs must be stopped during pregnancy, and pregnancy might cause the tumor to grow quickly.) Surgery can also be used when drug treatment doesn't work.

[Radiation](#) may be used if drug treatment and surgery do not work.

Treatment of somatotroph or growth hormone-secreting adenomas

Adults with these tumors often have [acromegaly](#)², while children have [gigantism](#)³.

[Surgery](#) is usually the first treatment for these adenomas, but it often can't remove all of the tumor. Sometimes, a somatostatin analog (see below) is given for a few months before surgery. This may cause the tumor to shrink, which could improve the chance that the surgery will remove all of the tumor, but doctors can't be certain before trying that this will help.

If growth hormone and insulin-like growth factor-1 (IGF-1) levels remain high after surgery, many experts recommend treating with [medicine](#) first. [Radiation therapy](#) is another option, but it's used most often when surgery and drug treatments don't work. (This is because radiation is very slow to act and over time it can lead to lowered levels of other pituitary hormones.)

Octreotide (Sandostatin), lanreotide (Somatuline Depot), and pasireotide (Signifor LAR) are man-made forms of the natural hormone somatostatin (they're called *somatostatin analogs*). These drugs return IGF-1 to normal levels in about 2 out of 3 patients. They are taken as injections, usually about once a month. The dose of these drugs may need to be adjusted based on blood IGF-1 levels.

Because these drugs work well and can be given monthly, doctors have started to question whether surgery should always be the first treatment for people with somatotroph adenomas. In those who might have problems with surgery, such as people with other major health problems, these drugs might be a good choice as the first treatment.

Another drug, pegvisomant, works by blocking the action of growth hormone. It can be used if somatostatin analogs (octreotide, lanreotide, or pasireotide) aren't doing enough to block growth hormone production.

Drugs such as cabergoline or bromocriptine can be used along with a somatostatin analog. This helps reduce growth hormone levels in about 1 out of 2 patients. But some patients have trouble tolerating the high doses often needed for these drugs to work. The good thing about these drugs is that they're taken as pills.

If surgery and drug treatments don't work, radiation therapy may be used.

Treatment of corticotroph or corticotropin (ACTH)-secreting adenomas

These tumors cause the adrenal glands to make too much of the steroid hormone cortisol, which leads to Cushing's disease. (See [Signs and Symptoms of Pituitary Tumors](#).⁴)

[Surgery](#) is usually the main treatment. If the surgery doesn't remove the tumor completely or if it grows back, the main options are a second surgery or [radiation therapy](#). Radiation can often take months or years to work, so [medicines](#) may be given to help control cortisol levels in the meantime.

If surgery and radiation don't control cortisol levels, treatment options may include using medicines or removing both of the adrenal glands (see below).

Several different types of medicines can be used to help control cortisol levels or limit the effects of this hormone in the body. (See [Medicines to Treat Pituitary Tumors](#).) But medicines don't work as well for ACTH-secreting tumors as they do in some other types of pituitary tumors. And some of these drugs can have serious side effects that make them hard to take for a long time.

If medicines aren't helpful, or if the patient can't take them because of side effects, both adrenal glands can be removed with an operation called a *bilateral adrenalectomy*. This can usually be done with laparoscopic surgery, using small incisions in the belly instead

of one large one. The surgeon works through these small incisions with special long, thin instruments, including one with a tiny video camera lens on the end (called a laparoscope) for looking into the belly. Adrenalectomy stops all cortisol production, so high cortisol levels will no longer be a problem. But after surgery patients will need to take pills to replace the adrenal steroid hormones for the rest of their life.

If the adrenal glands are to be removed, the pituitary gland will first be treated with radiation. If this isn't done, removing the adrenals can cause the pituitary tumor to get larger and even start growing into the structures near the pituitary. This is known as *Nelson syndrome*. When the adenoma gets large, it can damage the normal parts of the pituitary gland, causing problems from hormone deficiency. It can also lead to high levels of ACTH. Because ACTH is a lot like the hormone that causes tanning of the skin, the high ACTH levels make the skin darker.

Treatment of thyrotroph or thyrotropin (TSH)-secreting adenomas

The treatment of choice for these tumors is [surgery](#), which usually works well. Sometimes medicines are used before surgery to correct thyroid hormone levels and help shrink the tumor.

Sometimes [radiation therapy](#) may be used along with surgery. But radiation is not always helpful, and [medicines](#) may be needed to control the tumor's hormone production if surgery didn't work. Some of the drugs that can be helpful include octreotide, lanreotide, cabergoline, and bromocriptine. These are usually used only if other treatments have failed to control the tumor.

It's important to treat the pituitary tumor to keep it from damaging nearby structures. Drugs that stop the thyroid gland from making thyroid hormone can actually make things worse because reducing thyroid hormone production may cause the TSH-secreting pituitary tumor to grow.

Treatment of gonadotroph or gonadotropin (FSH/LH)-secreting adenomas

The hormones made by these tumors rarely cause major symptoms, so these tumors are often not found until they are large (macroadenomas) and pressing on nearby structures.

Treatment of these tumors is similar to that used for [non-functional adenomas](#). [Surgery](#) is often the best option because it works right away. [Radiation](#) may be given after surgery.

Follow up with frequent [MRI](#)⁵ scans will show if the tumor is growing back. If it is, options include radiation (if it hasn't been given already) or [medicines](#) such as dopamine agonists (cabergoline or bromocriptine) or somatostatin analogs (octreotide or lanreotide).

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
2. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
3. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
4. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
5. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html

References

Donoho DA, Bose N, Zada G, Carmichael JD. Management of aggressive growth hormone secreting pituitary adenomas. *Pituitary*. 2017;20(1):169-178.

Duan L, Zhu H, Xing B, Gu F. Prolonged preoperative treatment of acromegaly with Somatostatin analogs may improve surgical outcome in patients with invasive pituitary macroadenoma (Knosp grades 1-3): a retrospective cohort study conducted at a single center. *BMC Endocr Disord*. 2017;17(1):55.

Rotermund R, Riedel N, Burkhardt T, et al. Surgical treatment and outcome of TSH-producing pituitary adenomas. *Acta Neurochir (Wien)*. 2017;159(7):1219-1226.

Karaca Z, Yarman S, Ozbas I, et al. How does pregnancy affect the patients with pituitary adenomas: a study on 113 pregnancies from Turkey. *J Endocrinol Invest*. 2017 Jun 20.

Langlois F, McCartney S, Fleseriu M. Recent Progress in the Medical Therapy of Pituitary Tumors. *Endocrinol Metab (Seoul)*. 2017;32(2):162-170.

Yang C, Wu H, Wang J, et al. Successful management of octreotide-insensitive thyrotropin-secreting pituitary adenoma with bromocriptine and surgery: A case report and literature review. *Medicine (Baltimore)*. 2017;96(36):e8017.

Zhang LY1, Deng K, Zhang Y, et al. Treatment effects analysis of preoperative long-acting somatostatin analogs combined trans-sphenoidal endoscopic surgery for patients with growth hormone secreting pituitary macroadenomas. *Zhonghua Yi Xue Za Zhi*. 2017;97(5):375-379.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Treatment of Non-Functional Pituitary Tumors (Tumors That Don't Make Excess Hormones)

Not all pituitary tumors need to be treated right away, especially if they're not growing or [causing problems](#)¹. But large tumors and those that are clearly growing often do need treatment.

Large tumors

Large tumors (called macroadenomas) tend to cause symptoms and are most often treated with [surgery](#). This helps get rid of the symptoms and reduces the risk of damaging [tissues near the pituitary gland](#)² (like blood vessels, nerves, and the brain). [Radiation therapy](#) or [radiosurgery](#) might be done after surgery to kill any tumor cells that were left behind.

If a patient is not able to have surgery, radiation may be used as the main treatment.

MRI scans are done for many years after treatment. Eye exams and blood tests may be done, too. If there's tumor re-growth, more surgery or radiation may be used. Drug treatment is usually not helpful in treating these tumors, but [medicines](#) used to treat functional tumors may be tried. Some doctors have reported success using the chemotherapy drug temozolomide for fast-growing tumors.

Incidentalomas

These are small pituitary tumors (called microadenomas) that are seen on scans done for other reasons. They usually don't cause symptoms because they're not big enough to press on nearby structures and they don't secrete high levels of any hormone.

Most of these tumors do not change, and many doctors recommend just watching them. Regular physical exams and yearly MRI scans will be done to see if they start growing. Hormone levels may be checked, too. If the tumor starts growing or causing symptoms, it can then be treated. But the important point is that people with incidentalomas shouldn't get tests or treatments that they don't really need.

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
2. www.cancer.org/cancer/pituitary-tumors/about/what-is-pituitary-tumor.html

References

Aghi MK, Bodach ME, Tumialab LM, et al. Congress of Neurological Surgeons (CNS) and the AANS/CNS Tumor Section. *Guidelines on the Management of Patients with Nonfunctioning Pituitary Adenomas: Introduction and Methodology*. Accessed at www.cns.org/guidelines/guidelines-management-patients-non-functioning-pituitary-adenomas/Chapter_1 on October 16, 2017.

Lucas, JW, Bodach ME, Tumialab LM, et al. Congress of Neurological Surgeons (CNS) and the AANS/CNS Tumor Section. *Systematic Review and Evidence-based Guideline on Primary Management of Patients with Nonfunctioning Pituitary Adenomas*. Accessed at www.cns.org/sites/default/files/guideline-chapter-pdf/nfpa-chapter-5.pdf on October 16, 2017.

Mercado M, Melgar V, Salame L, Cuenca D. Clinically non-functioning pituitary adenomas: Pathogenic, diagnostic and therapeutic aspects. *Endocrinol Diabetes Nutr*. 2017;64(7):384-395.

Molitch ME. Diagnosis and Treatment of Pituitary Adenomas: A Review. *JAMA*. 2017;317(5):516-524.

National Cancer Institute. Pituitary Tumors Treatment (PDQ®)—Patient Version. August

18, 2017. Accessed at www.cancer.gov/types/pituitary/patient/pituitary-treatment-pdq on October 16, 2017.

Sadik ZHA, Voormolen EHJ, Depauw PRAM, et al. Treatment of Nonfunctional Pituitary Adenoma Postoperative Remnants: Adjuvant or Delayed Gamma Knife Radiosurgery? *World Neurosurg.* 2017;100:361-368.

Sheehan J, Lee CC, Bodach ME, et al. Congress of Neurological Surgeons (CNS) and the AANS/CNS Tumor Section. *Management of Patients with Residual or Recurrent Nonfunctioning Pituitary Adenomas.* Accessed at www.cns.org/guidelines/guidelines-management-patients-non-functioning-pituitary-adenomas/Chapter_7 on October 16, 2017.

Tampourlou M, Ntali G, Ahmed S, et al. Outcome of Nonfunctioning Pituitary Adenomas That Regrow After Primary Treatment: A Study From Two Large UK Centers. *J Clin Endocrinol Metab.* 2017;102(6):1889-1897.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Treatment of Pituitary Carcinomas

[Pituitary carcinomas](#)¹ are very rare tumors that have already spread to other parts of the body when they're found. Because so few people around the world have this cancer, it's been difficult to learn much about it, and it's hard to diagnose and treat. At this time, most treatment is focused on easing the problems caused by the cancer. This is called [supportive or palliative care](#)².

[Surgery](#) and [radiation therapy](#) are the main forms of treatment used. They may decrease tumor size, slow tumor growth, and help prevent or relieve symptoms. Surgery may be repeated, if needed.

[Medicines](#) are used to manage hormone levels in functional pituitary carcinomas. These are the same drugs used to treat pituitary adenomas, but higher doses and combinations of drugs may be needed.

[Chemotherapy](#) and newer targeted therapy drugs may be tried, but it's not fully clear that these treatments improve survival. A chemo drug called temozolomide has been found to help and may be tried if surgery and radiation don't work. Because pituitary carcinoma affects so few patients, it's hard to study which treatments might be effective. Taking part in a [clinical trial](#)³ of a new treatment may be a good option.

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/about/what-is-pituitary-tumor.html
2. www.cancer.org/treatment/treatments-and-side-effects/palliative-care.html
3. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

References

Curtò L. Temozolomide therapy: Focus on patients with pituitary carcinoma. *J Neurosci Rural Pract.* 2016;7(3):335–336.

Halevy C, Whitelaw BC. How effective is temozolomide for treating pituitary tumours and when should it be used? *Pituitary.* 2017;20(2):261-266.

Hansen TM, Batra S, Lim M, et al. Invasive adenoma and pituitary carcinoma: a SEER database analysis. *Neurosurg Rev.* 2014;37(2):279-285; discussion 285-286.

Heaney AP. Pituitary Carcinoma: Difficult Diagnosis and Treatment. *J Clin Endocrinol Metab.* 2011; 96(12): 3649–3660.

Ji Y, Vogel RI, Lou E. Temozolomide treatment of pituitary carcinomas and atypical adenomas: systematic review of case reports. *Neurooncol Pract.* 2016;3(3):188-195.

See all references for Pituitary Tumors (www.cancer.org/cancer/pituitary-tumors/references.html)

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Our team is made up of doctors and oncology certified nurses with deep knowledge of cancer care as well as journalists, editors, and translators with extensive experience in medical writing.

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After Pituitary Tumor Treatment

Living Well After Treatment

For many people, completing treatment often raises questions about next steps as a survivor.

- [Living as a Pituitary Tumor Survivor](#)

Living as a Pituitary Tumor Survivor

For most people with [pituitary tumors](#)¹, treatment can remove or control the tumor. The end of treatment can be both stressful and exciting. You may be relieved to finish treatment, but it's hard not to worry about the tumor growing or coming back. This is a very common concern in people who have had a pituitary tumor.

It may take a while before your fears lessen. But it may help to know that many pituitary tumor survivors have learned to live with this uncertainty and are living full lives.

For other people, the tumor might never go away completely. Some people may continue to get medicines or other treatments to help keep the tumor in check. Learning to live with a tumor that doesn't go away can be difficult and very stressful. It has its own type of uncertainty.

Follow-up care

Follow-up care is very important after treatment for pituitary tumors. Even if you have completed treatment, your doctors will still want to watch you closely. Keep all of your appointments with your health care team and follow their instructions carefully. Report any new or returned symptoms to your doctor right away. Ask questions if you don't understand what your doctor says.

[Surgery](#)² is often the first treatment for many types of pituitary adenomas. If you had a functional (hormone-making) pituitary adenoma, hormone level tests can often be done within days or weeks after surgery to see if treatment worked. Blood tests will also be done to see how well the remaining normal pituitary gland is working. If the results show that the tumor was removed completely and that pituitary function is normal, you'll still need regular visits with your doctor. Your hormone levels may need to be checked again in the future to check to see if the adenoma comes back. Whether or not the tumor made hormones, MRI scans are often done as a part of follow-up. Depending on the size of the tumor and the extent of surgery, you may also be seen by a neurologist to check your brain and nerve function and an ophthalmologist (eye doctor) to assess your vision.

After [radiation treatment](#)³, you will need check-ups for several years. The response of the tumor to radiation therapy is hard to predict, and while the benefits and side effects of treatment can be seen within months, some might take years to know how well it worked. Your pituitary function will be checked at regular intervals. MRI scans will be the main follow-up tests, along with testing hormone levels if your tumor made hormones.

It's common for people to have low pituitary hormone levels after surgery or radiation therapy. These people will need hormone replacement. Thyroid hormone and adrenal steroids can be taken as pills. In men, testosterone can be given to restore sex drive and help prevent osteoporosis (weak bones). Testosterone is available as a gel, liquid, or patch applied to the skin. It can also be given as a monthly injection or implanted as a pellet under the skin every few months. In young women, estrogen is given either by pills or a skin patch to avoid early menopause. Often, progesterone is given along with estrogen. Pituitary hormone deficiency can affect a woman's ability to have children. But it may be possible with hormone therapy.

If you're taking medicine for a prolactinoma, you will have your hormone levels checked at least once or twice a year. If an MRI shows that the tumor has shrunk after treatment, the MRI might not need to be repeated, depending on the size of the tumor and whether the response is partial or complete. If you have a prolactin-producing microadenoma, you may be able to stop drug treatment after several years of therapy. Your doctor might recommend stopping the drug and then checking your prolactin level. If it stays normal, you may be able to stay off the drug.

For patients getting drug therapy for corticotropin (ACTH)-producing or growth hormone-producing adenomas, follow-up may be more frequent. Your hormone levels and symptoms will be watched carefully. People with growth hormone-producing adenomas have an increased risk of developing high blood pressure and heart failure. They also have a higher risk of getting [colon cancer](#)⁴. Periodic check-ups for these conditions are recommended.

Diabetes insipidus (see [Signs and Symptoms of Pituitary Tumors](#)⁵) can be a short-term result of surgery, but in some cases it might last longer. It can usually be treated. If the problem is mild, simply taking in enough fluids might treat this problem. For more severe problems, the drug called desmopressin is given either by nasal spray or by tablet. It's always important to drink enough fluids to avoid dehydration.

It's also important to consider whether your pituitary tumor might be a clue to a genetic syndrome in your family. Some people with pituitary tumors might be able to have genetic tests done to look for certain gene changes. If a change is found, family members might want to be tested as well to see if they are at increased risk.

Sometimes people with large or fast-growing pituitary adenomas may be disabled or have their lives shortened because the tumor or its treatment destroys vital brain tissue near the pituitary gland, but this is rare. In general, when a pituitary tumor is not cured, people live out their lives but may have to deal with problems caused by the tumor or its treatment, such as vision problems or hormone levels that are too high or too low.

Ask your doctor for a survivorship care plan

Talk with your doctor about developing a survivorship care plan for you. This plan might include:

- A suggested schedule for follow-up exams and tests
- A schedule for other tests you might need in the future, such as early detection (screening) tests for cancer, or tests to look for long-term health effects from your tumor or its treatment
- A list of possible late- or long-term side effects from your treatment, including what to watch for and when you should contact your doctor
- Diet and physical activity suggestions
- Reminders to keep your appointments with your primary care provider (PCP), who will monitor your general health care

Keeping health insurance and copies of your medical records

Even after treatment, it's very important to keep health insurance. Tests and doctor visits cost a lot, and even though no one wants to think of their tumor coming back, this could happen.

At some point after your treatment, you might find yourself seeing a new doctor who doesn't know about your medical history. It's important to keep copies of your medical records to give your new doctor the details of your diagnosis and treatment. Learn more in [Keeping Copies of Important Medical Records](#)⁶.

Can I lower my risk of the pituitary adenoma progressing or coming back?

If you have (or have had) a pituitary tumor, you probably want to know if there are things you can do that might lower your risk of it growing or coming back, such as exercising, eating a certain type of diet, or taking nutritional supplements. Unfortunately, it's not yet clear if there are things you can do that will help.

Adopting healthy behaviors such as [not smoking](#)⁷, [eating well](#)⁸, [getting regular physical activity](#)⁹, and [staying at a healthy weight](#)¹⁰ might help, but no one knows for sure. But we do know that these types of changes can have positive effects on your health.

About dietary supplements

So far, no [dietary supplements](#)¹¹ (including vitamins, minerals, and herbal products) have been shown to help lower the risk of a pituitary tumor growing or coming back. This doesn't mean that no supplements will help, but it's important to know that none have been proven to do so.

Dietary supplements are not regulated like medicines in the United States – they don't have to be proven effective (or even safe) before being sold, but there are limits on what they're allowed to claim they can do. If you're thinking about taking any type of nutritional supplement, talk to your health care team. They can help you decide which ones you can use safely while avoiding those that might be harmful.

Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/about/what-is-pituitary-tumor.html
2. www.cancer.org/cancer/pituitary-tumors/treating/surgery.html

3. www.cancer.org/cancer/pituitary-tumors/treating/radiation-therapy.html
4. www.cancer.org/cancer/colon-rectal-cancer.html
5. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
6. www.cancer.org/treatment/survivorship-during-and-after-treatment/be-healthy-after-treatment/keeping-copies-of-important-medical-records.html
7. www.cancer.org/healthy/stay-away-from-tobacco.html
8. www.cancer.org/healthy/eat-healthy-get-active/eat-healthy.html
9. www.cancer.org/healthy/eat-healthy-get-active/get-active.html
10. www.cancer.org/healthy/eat-healthy-get-active/take-control-your-weight.html
11. www.cancer.org/treatment/treatments-and-side-effects/complementary-and-alternative-medicine/dietary-supplements.html

References

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