# Treating Pituitary Tumors

**How are pituitary tumors treated?**

The types of treatments that might be used for pituitary tumors include:

- Surgery for Pituitary Tumors
- Radiation Therapy for Pituitary Tumors
- Medicines to Treat Pituitary Tumors

**Common treatment approaches**

While many pituitary tumors need to be treated, not all of them do. For example, if a tumor is found on an imaging test done for some other reason and it's not causing any problems, watching the tumor instead of treating it right away might be an option to manage the tumor.

When a pituitary tumor needs to be treated, the approach to treatment differs 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
- **Otolaryngologist:** a doctor who treats conditions of the ears, nose, and throat (also known as an ENT doctor or ENT surgeon).
- **Ophthalmologist:** a doctor who treats problems with the eyes
- **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 (PAs), nurse practitioners (NPs), nurses, psychologists, social workers, rehabilitation specialists, and other health professionals.

- Health Professionals Associated with Cancer Care

**Making treatment decisions**

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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 Trials

**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 Integrative Medicine

*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 your cancer care team any questions you may have about your treatment options.*

# Surgery for Pituitary Tumors

Surgery is the main treatment for many pituitary tumors. How the surgery is done (and how well it works) depends on several factors, including the type of tumor, its size and location, and if it has spread into nearby structures.

## Transsphenoidal surgery

This is the most common way to remove pituitary tumors. Transsphenoidal 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 is just below the pituitary gland.


More and more, this surgery is done by a team of surgeons that includes a neurosurgeon and an otolaryngologist (ENT surgeon).

To reach the pituitary, the surgeon first makes a small cut inside the nose, and then opens the bony walls of the sphenoid sinus with small surgical instruments. Other small tools are then passed through the opening to remove the tumor.

The surgeon can look at the tumor and nearby structures with an **endoscope**, a thin fiber-optic tube with a tiny video camera at the tip.

No part of the brain is touched during transsphenoidal surgery, so the chance of damaging the brain is very low. There are fewer side effects with this approach than

with craniotomy (see below), and there's also no visible scar. But it’s sometimes harder to take out large tumors this way.

When this surgery is done by an experienced neurosurgeon and the tumor is small (a microadenoma[1]), the chances that it can be removed completely are high. 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 of removing the tumor completely are lower,

## More information about Surgery

For more general information about surgery as a treatment for cancer, see Cancer Surgery[3].

To learn about some of the side effects listed here and how to manage them, see Managing Cancer-related Side Effects[4].

## Hyperlinks

1. www.cancer.org/cancer/pituitary-tumors/about/what-is-pituitary-tumor.html
2. www.cancer.org/cancer/pituitary-tumors/detection-diagnosis-staging/signs-and-symptoms.html
3. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery.html
4. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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# Radiation Therapy for Pituitary Tumors

Radiation therapy uses high energy x-rays or particles to kill tumor cells. For this type of treatment, you'll see a doctor called a **radiation oncologist**. Radiation is directed at the tumor from a source outside the body.

## When might radiation therapy be used?

Radiation therapy may be recommended to treat a pituitary tumor if:

- Surgery isn't an option for some reason
- Some of the pituitary tumor remains or comes back after surgery
- The tumor causes symptoms that aren’t controlled with medicines

Radiation therapy can work well, especially in controlling tumor growth. However, it tends to work more slowly in controlling excess pituitary hormone production. It can often take months or even years before excess hormone production is fully controlled.

## How is radiation therapy given?

Radiation therapy is much like getting an x-ray, but the doses of radiation used are much stronger.

Before your treatments start, the radiation team will get imaging tests[1] such as MRI scans[2] to map out the exact location, size, and shape of the tumor. This planning session, called **simulation**, is used to determine the correct angles for aiming the

radiation beams, the shape of the beams, and the proper dose of radiation.

The treatment itself is not painful. You lie on a special table while a machine delivers the radiation from precise angles. Each session typically 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.

## Types of radiation therapy

The main ways to give radiation therapy for pituitary tumors are:

- Fractionated radiation therapy
- Stereotactic radiosurgery (SRS)/stereotactic radiation therapy (SRT)

The choice of which one to use depends on factors such as the size and location of the tumor, if the tumor is making excess hormones, and the availability of nearby treatment facilities.

### Fractionated radiation therapy

In this approach, the total dose of radiation is broken up (fractionated) into smaller doses, which are usually given 5 times a week over 4 to 6 weeks.

Higher doses of radiation can damage normal brain tissue, so doctors try to deliver the radiation to the tumor while giving the lowest possible dose to normal surrounding brain areas. Some newer techniques can help doctors focus the radiation more precisely.

**Intensity modulated radiation therapy (IMRT):** IMRT is an advanced form of 3D radiation therapy. It uses the results of imaging tests such as MRI and special computers to map the location of the tumor precisely. Then a computer-driven machine moves around the patient to deliver 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.

**Proton beam radiation therapy:** This form of treatment uses beams of protons rather than x-rays to kill tumor cells. Protons are positive parts of atoms.

Unlike x-rays, which release energy both before and after they hit their target, protons

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 brain tissue.

Proton beam radiation therapy requires highly specialized equipment and isn't available everywhere – there are a limited number of proton beam centers in the United States at this time.

**Stereotactic radiosurgery (SRS)/stereotactic radiation therapy (SRT)**

This type of treatment delivers a large, precise radiation dose to the tumor area, either in one treatment session (for SRS) or in a few sessions (for SRT). There is no actual surgery in this treatment. Radiosurgery targets the tumor precisely, limiting the radiation exposure to nearby structures and the rest of the brain.

A head frame might be attached to the skull to help aim the radiation beams. (Sometimes a mesh face mask is used to hold the head in place instead.) Once CT[3] or MRI[4] scans have shown the exact location of the tumor, radiation is focused on it from many different angles.

- In one approach, thin radiation beams from a machine are focused on 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.
- Another approach uses a movable linear accelerator (a machine that creates radiation) that's controlled by a computer. Instead of delivering many beams at once, this machine moves around the patient's head to deliver a thin beam of radiation to the tumor from many different angles. Several machines with names such as X-Knife, CyberKnife, and Clinac are used for this type of stereotactic radiosurgery.

SRS typically delivers the whole radiation dose in one session, though it may be repeated if needed. For SRT (sometimes called **fractionated radiosurgery**), doctors give the radiation in several treatments to deliver the same or a slightly higher dose.

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 might not be a good option for tumors that are very close to the optic nerves. It also might not be helpful for tumors that have an unusual shape.

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- Drugs for non-functional pituitary tumors
- Drugs for aggressive pituitary tumors and pituitary carcinomas

## Drugs for lactotroph adenomas (prolactinomas)

Prolactinomas make too much prolactin, which might cause symptoms[1] such as lowered sexual function, or excess milk production in younger women. These tumors might also grow large enough to press on nearby nerves, causing symptoms such as headaches or changes in vision.

**Dopamine agonists** can usually stop prolactinomas from making too much prolactin and can shrink these tumors. One of these drugs is often the only treatment needed for these tumors. **Cabergoline** and **bromocriptine (Parlodel)** are most commonly used. Both drugs work well, but cabergoline seems to work better, and it can be taken once or twice a week instead of every day.

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. 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 (growth hormone-secreting tumors)

These tumors make too much growth hormone (GH), which can lead to acromegaly in adults and gigantism in children. (See Signs and Symptoms of Pituitary Tumors.[2])

Medicines do not work as well for these tumors as they do for some other types of pituitary tumors. Surgery is often the first treatment for these tumors, but medicines might be helpful if the tumor can't be removed completely, or if a person can't have surgery for some reason.

### *Somatostatin analogs*

**Octreotide (Sandostatin, Mycapssa)**, **lanreotide (Somatuline Depot)**, and **pasireotide (Signifor LAR)**

Somatostatin, which is made in the pituitary and other glands, blocks the production of GH (also known as somatotropin) by adenomas.

Octreotide is often the first drug tried for these tumors, because the dose can be adjusted if needed. It is first given as an injection under the skin, typically 3 times a day.

All 3 of these drugs are also available in longer-acting forms, which can be injected under the skin every 4 to 6 weeks. Octreotide and lanreotide are used more often. Pasireotide is more likely to raise blood glucose (sugar) levels, so it usually isn't used unless the other drugs don’t work.

Octreotide is also available as a capsule that can be taken by mouth, typically twice a day. This might be an option for people whose tumors have responded to long-acting octreotide or lanreotide injections.

Doctors measure how well these drugs are working by checking blood GH and IGF-1 levels. These drugs can return IGF-1 levels to normal in about half of patients, although tumors tend to shrink very slowly.

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)** works by blocking the action of growth hormone (GH) on other cells. It's very effective in lowering blood IGF-1 levels, but it doesn’t block GH secretion by the pituitary gland. It also doesn't shrink pituitary tumors, so regular MRIs are needed to make sure the tumor isn't growing.

This drug is injected under the skin, typically once a day, but over time it may be given less often, such as every other day. It can be used alone, along with a somatostatin analog, or along with cabergoline (see below).

Pegvisomant tends to have few side effects, but it can lower blood sugar levels and cause mild liver damage in some people.

### *Dopamine agonists*

Dopamine agonists such as **cabergoline** or **bromocriptine,** described in more detail

above in “Drugs for lactotroph adenomas (prolactinomas),” can reduce GH levels in some people, although they don’t seem to be as effective as somatostatin analogs. Higher doses are needed for these tumors than for prolactinomas, and some people 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 (ACTH-secreting tumors)

These tumors cause the adrenal glands to make excess steroid hormones such as cortisol, which can lead to Cushing’s disease (see Signs and Symptoms of Pituitary Tumors[3]).

Surgery is typically the preferred treatment for these tumors, if possible. Medicines are not usually part of treatment for these tumors unless surgery and radiation therapy don’t work or are not good options. (Medicines can also sometimes be used while waiting for radiation to take effect, which can often take many months.)

Many kinds of drugs can be tried, but they don’t always work as well for ACTH-secreting tumors as they do for some other types of pituitary tumors.

- **Pasireotide (Signifor)** can help some people who have Cushing’s disease when surgery is not an option or has not worked. It is injected under the skin, twice a day. Along with side effects such as nausea, vomiting, and diarrhea, this drug can cause high blood sugar levels and gallstones.
- **Cabergoline** also can help some people with Cushing’s disease. For more about this drug, see “Drugs for lactotroph adenomas (prolactinomas).”
- **Steroidogenesis inhibitors** can be used to keep the adrenal gland from making cortisol, but they don’t affect the pituitary tumor itself. These drugs include **osilodrostat (Isturisa)**, **ketoconazole**,**levoketoconazole**, **etomidate**, **metyrapone**, and **mitotane**. These drugs can sometimes be helpful after surgery or radiation (or if surgery is not an option), but they can often be hard to take because of their side effects.
- **Mifepristone** is 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.

## Drugs for thyrotroph adenomas (thyrotropin [TSH]-secreting tumors)

The main treatment for these rare tumors is typically surgery to try to remove the tumor completely. But it's important to restore thyroid hormone levels to normal before surgery. This is usually done by giving a somatostatin analog such as **octreotide** (see "Drugs for somatotroph adenomas") for several months before the surgery. This might also help shrink the tumor and make the surgery easier.

A somatostatin analog might also be used after surgery if the tumor isn't removed completely. Dopamine agonists such as **cabergoline** or **bromocriptine** also can be used. More details on these drugs are given above, in "Drugs for lactotroph adenomas (prolactinomas)."

### Drugs for non-functional pituitary tumors

These tumors don't make excess hormones. Surgery is typically the first treatment for these tumors, which might be followed by radiation if the tumor can't be removed completely or if it comes back after surgery.

If these treatments aren't effective, drugs such as dopamine agonists or somatostatin analogs (discussed above) might be helpful for some people, although studies of these medicines have had mixed results.

### Drugs for aggressive pituitary tumors and pituitary carcinomas

These types of tumors are uncommon, but they tend to grow quickly. They might invade nearby structures or spread to other parts of the body.

For functioning tumors (those making excess hormones), many of the same drugs described above can be used (depending on which hormone the tumor makes), although higher doses and/or combinations of drugs might be needed.

Because these tumors tend to grow quickly, chemotherapy drugs, which attack rapidly growing cells, can sometimes be helpful. **Temozolomide** is the chemo drug used most often, but others may be tried if isn't working.

## 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

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

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# Treatment of Functional (Hormone-Making) Pituitary Tumors

The treatment of functional pituitary adenomas (tumors that make excess hormones) depends on which type of hormone they make.

***Jump to a section***



## Treatment of lactotroph adenomas (prolactinomas)

Unlike most other pituitary tumors, surgery is usually not the first treatment for these prolactin-secreting tumors.

Sometimes these tumors can just be watched, without treating them right away. If the tumor isn't very large and isn't causing bothersome symptoms, blood prolactin levels can be checked regularly. If they start to go up, an MRI[1] can be done to see if the tumor is growing.

If treatment is needed, medicines known as dopamine agonists (**cabergoline or bromocriptine**) are used first. (See Medicines to Treat Pituitary Tumors.) They usually lower prolactin levels and shrink (or slow the growth of) prolactinomas well enough so that surgery isn't needed.

These drugs usually lower prolactin levels within a few weeks, and they often shrink tumors within a few months (although sometimes this takes longer).

If treatment with one of these medicines works, a person might take it for the rest of their life. However, if treatment continues to work over time (typically at least 2 years) and MRI scans no longer show a tumor, stopping the medicine may be an option. You would still need regular checks of prolactin levels to see if the tumor comes back.

If the tumor doesn't respond well enough to the initial dose of the drug, going to a higher dose or switching to a different drug might be tried. If this isn't helpful, or if the side

effects of the drug are too bothersome, surgery is usually done to try to remove the tumor.

Radiation therapy may be used after surgery to try to lower the risk of the tumor coming back, especially for larger tumors (macroadenomas). It might also be an option if drug treatment and surgery do not work.

For women with prolactinomas who want to become pregnant, a dopamine antagonist can be used both to treat the tumor and help restore regular menstrual cycles. However, these drugs haven't been studied extensively during pregnancy, so to be safe they are usually stopped once a woman becomes pregnant. If the tumor grows large enough during the pregnancy to cause symptoms, the drug can be started again.

## Treatment of somatotroph adenomas (growth hormone-secreting tumors)

Pituitary tumors that make too much growth hormone (GH) can cause acromegaly in adults and gigantism in children. (For more on these conditions, see Signs and Symptoms of Pituitary Tumors[2].)

Surgery is usually the first treatment for these adenomas. The goal is to remove all of the tumor, although this isn't always possible, especially for larger tumors. Sometimes, **octreotide** or **lanreotide** (somatostatin analogs) might be given for a few months before surgery. This may shrink the tumor and help with other symptoms, which might improve the chance of removing the tumor completely.

Blood levels of GH and insulin-like growth factor-1 (IGF-1) will be checked a few months after surgery, typically along with an MRI to look for signs of tumor. If any tumor remains, options might include a second surgery (if it can be done) or drug treatment with a somatostatin analog. Radiation therapy might be another option, but it's used most often when surgery and drug treatments don't work. (This is because radiation is often very slow to work, and over time it can lead to low levels of other pituitary hormones.)

For people who can't have surgery for some reason (or who don't want surgery), treatment with a somatostatin analog is typically the first treatment.

If the somatostatin analog isn't working, other types of drugs might be tried, such as **pegvisomant** (a GH antagonist), or **cabergoline** or **bromocriptine** (dopamine agonists). For more on the drugs used to treat these tumors, including how they're given and possible side effects, see Medicines to Treat Pituitary Tumors.

These rare tumors make too much thyroid-stimulating hormone (TSH), which causes the thyroid to make excess thyroid hormones.

The main treatment for these tumors is typically surgery. This usually works well for smaller tumors, although larger tumors are often harder to remove completely. It's important to restore thyroid hormone levels to normal before surgery. This is usually done by giving a somatostatin analog such as **octreotide** (see Medicines to Treat Pituitary Tumors) for several months before the surgery. This might also help shrink the tumor and help make the surgery easier.

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

Some pituitary adenomas don’t make enough excess hormones for them to cause symptoms. Most of these **non-functional pituitary tumors** are gonadotroph adenomas that don’t make enough hormones to cause any problems.

Not all of these tumors need to be treated right away, especially if they're small and not growing or causing symptoms. But large tumors and those that are clearly growing often do need treatment.

## Large pituitary tumors (macroadenomas)

Most non-functioning pituitary tumors grow large enough to cause local symptoms[1] such as vision problems or headaches before they are found. They might also cause symptoms by pressing on the normal parts of the pituitary, which can lead to lower levels of pituitary hormones.

These **macroadenomas** are most often treated with surgery if it can be done. The goal of surgery is to remove as much of the tumor as possible. This can usually help relieve any symptoms the tumor is causing and can lower the chances the tumor will come back and cause problems in the future. Some macroadenomas can be removed completely, but this might not be possible for other tumors, based on their size and location.

If the tumor can’t be removed completely, if it comes back after surgery, or if a person

can’t have surgery for some reason, radiation therapy might be done. Radiation tends to work very slowly (over many months), so it’s not usually the first treatment tried, especially in people who are having symptoms. Because radiation works slowly, medicines might be tried in the meantime to help relieve any symptoms the tumor is causing, although drugs aren’t always helpful for non-functioning tumors (see below).

MRI scans typically are done for many years after treatment. Eye exams and blood tests of hormone levels may be done, too. If the tumor comes back, more surgery or radiation may be used.

Medicines are not usually not helpful in treating non-functioning tumors, but some of the same drugs used when treating functioning pituitary tumors may be tried if surgery and radiation therapy aren't good options. Some doctors have reported success using the chemotherapy drug **temozolomide** for fast-growing tumors.

### Pituitary incidentalomas

These are pituitary tumors that are seen on scans of the head done for other reasons. Many of these are smaller tumors (microadenomas), but some of them are larger (macroadenomas). These tumors usually don't cause obvious symptoms because they're not big enough to press on nearby structures and they don't make excess levels of any hormone.

For **larger incidentalomas**, tests and exams are often done to see if the tumor is making any excess hormones, or if it is causing subtle symptoms that a person might not be aware of. If either of these is true, then treatment is often recommended. (See above or Treatment of Functional (Hormone-Making) Pituitary Tumors.) Otherwise, the tumor often can be watched closely over time with MRIs to see if it is growing.

**Smaller incidentalomas** usually do not change over time, and doctors often recommend just watching them with regular MRI scans to see if the tumor starts growing. Hormone levels may be checked, too, although not all doctors agree in which ones should be checked or how often. If the tumor does start growing or causing symptoms, it can then be treated. But it's important to find the right balance so that people with incidentalomas aren't getting tests or treatments that they don't really need.

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

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# Treatment of Pituitary Carcinomas

Pituitary carcinomas[1] are very rare tumors that usually have already spread to other parts of the body by the time they're found. Because so few people have had this type

of cancer, it's been difficult to learn much about it, so it can be hard to diagnose and treat. Whenever possible, a team of medical experts should discuss the cancer before deciding on which tests and treatment options might be best.

Surgery is usually the first treatment if it can be done. Surgery might be done to remove tumors in other parts of the body as well. Radiation therapy might also be an option, either after surgery or for people who can't have surgery for some reason. These treatments may help prevent or relieve symptoms by removing the tumor, shrinking it, or slowing its growth. If the tumor isn't removed completely or if it starts to grow again, a second surgery may be an option.

For functional pituitary carcinomas (those that make excess hormones), the same medicines used to treat pituitary adenomas can be tried, but higher dose 0.151rcinomas8s2pituitary ad

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