Shands at the University of Florida

Treatment of Pituitary Tumors

A guide for you and your family

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INTRODUCTION

You have been referred for pituitary tumor evaluation to a University of Florida neurosurgeon who practices at Shands at UF. This booklet was prepared to assist you in understanding the best method of treatment for a pituitary tumor, which may include drug and/or radiation therapy, surgery or a combination of both. There are some tumors that are best observed without treatment because of their very slow growth. Following treatment, you will be seen at regular intervals to monitor your condition.

WHAT IS THE PITUITARY GLAND?

The pituitary gland, located at the base of the brain, is a small organ about the size of an acorn. It is surrounded by a bony saddle-like structure above the sinuses at the back of the nose called the sella turcica. The pituitary gland is sometimes referred to as the "master gland" because it releases substances that control the basic functions of growth, metabolism, and reproduction.

The pituitary gland secretes substances that change the activity level of the thyroid and adrenal glands, the testicles in the male, and the ovaries in the female.

The pituitary gland is divided into two parts, called lobes. These are referred to as the anterior (front) and the posterior (back) lobes. Each lobe releases hormones, which control basic activities within the body. The specific hormones and their activities are shown in Figure 1.

Pituitary tumors almost always are benign. It is rare for them to ever become malignant.

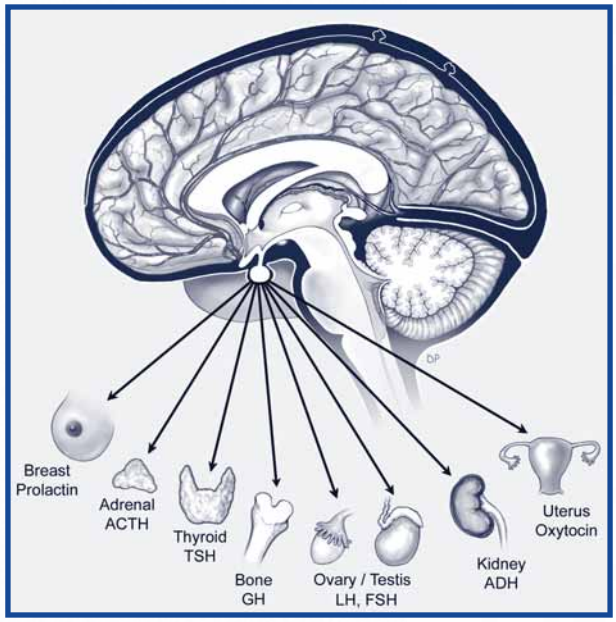

Figure 1: Organs and structures regulated by pituitary hormones. The name of the pituitary hormone is listed below the name of the organ.

UNDERSTANDING YOUR SYMPTOMS

A tumor in the pituitary gland causes symptoms by either releasing too much of a hormone or by pressing on the gland, causing it to release too little hormone. Symptoms are often determined by the type of tumor. A tumor that secretes hormones produces symptoms by releasing too much of the hormone.

Some tumors cause the gland to stop releasing enough hormones. In this case, symptoms arise from lack of hormones. A pituitary tumor also may cause symptoms by growing and pressing on the structures surrounding the pituitary gland, such as the nerves to the eyes.

A pituitary tumor can cause an increase in any of the anterior pituitary hormones listed in Table 1. Examples include:

- An increase in the amount of growth hormone (GH) causes the body to grow at an abnormally fast rate. Bones become thicker, the hands and feet may appear wider or thicker and the jaw may protrude. This condition is called acromegaly.
- If a tumor releases adrenocorticotrophic hormone (ACTH), it causes increased cortisol, which leads to fat deposits, especially in the shoulders, face, and abdomen. This condition is called Cushing's disease.
- Elevated levels of prolactin may cause secretion of breast fluids in women and decreased sexual drive in men and women. It also may cause irregular or absent menstrual periods in women, and difficulty in having an erection or infertility in men.

Because the pituitary gland is located within the skull, when a tumor becomes large, it may cause headaches that worsen as it grows. Also, since the pituitary gland is located near the eyes, a pituitary tumor can press on the nerves to the eyes and cause vision loss. Loss of peripheral vision (see Figure 2 on page 4) may occur first and be undetectable, but it may progress to eventual blindness if the pressure is not removed from the nerve. The tumor may also press on the nerves that move the eye and cause double vision. If the tumor is very large, it may press on other parts of the brain and cause problems with memory, weakness or numbness.

TABLE 1: Pituitary Hormones and their Actions

ANTERIOR LOBE	FUNCTIONS
Thyroid Stimulating Hormone (TSH)	Causes the thyroid gland to grow and releases thyroid hormones (Called T4 and T3)
Adrenocorticotrophic Hormone (ACTH)	Causes the adrenal gland to release several hormones. The major one is cortisol
Growth Hormone (GH)	The main hormone for general body growth and body composition
Follicle Stimulating Hormone (FSH)	Stimulates ovulation in women and the production of sperm in men
Luteinizing Hormone (LH)	Stimulates ovulation in women and testosterone production in men
Prolactin	Responsible for breast milk production in females
POSTERIOR LOBE	**FUNCTION**
Antidiuretic Hormone (ADH)	Controls thirst and the amount of urine produced by the kidneys
Oxytocin	Stimulates uterine contractions in women

TREATMENT OPTIONS

Because the pituitary gland affects many systems, several types of doctors may be involved in your care. These doctors are medical specialists who will recommend certain tests to evaluate your pituitary tumor based on your symptoms. Special tests called CT and MRI scans will be ordered to evaluate the size of the pituitary tumor. These are similar to X-rays. Neither of these scans is painful or requires special preparation. An ophthalmologist may perform visual field tests to evaluate any visual problems caused by the tumor. An endocrinologist, the hormone expert involved in your care, will monitor the hormone levels in your blood and urine and make recommendations based on the results of these tests.

Most pituitary tumors can be cured with the treatments that are available. There are four different types of treatment approaches that can be taken after a pituitary tumor has been diagnosed. These are:

- Observation over a period of time to see if treatment is needed
- Drugs
- Surgery
- Radiation therapy

One or more of these treatments may be combined. The most common treatment is a surgical procedure performed through the nose called a transsphenoidal operation.

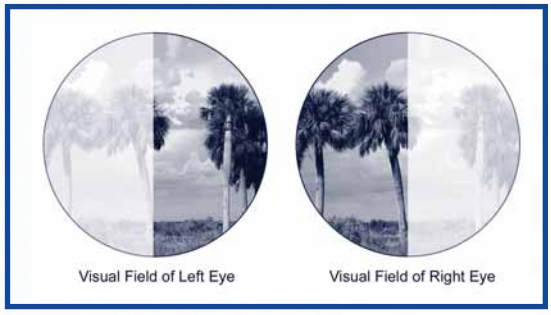

Figure 2: The most common visual problem is a loss of peripheral vision on the temple side of the visual field of both eyes and is called a bitemporal hemianopia.

OBSERVATION WITHOUT TREATMENT

Some pituitary tumors may be observed without treatment because they grow very slowly. Observation without treatment also may be recommended if present conditions seriously increase the risk of surgical or other treatments. Because pituitary tumors are slow growing, patients often can be observed without treatment for long periods of time without the tumor causing serious problems. This often is the recommended form of treatment forpatients who are age 70 (however, there is no specific age limitfor pituitary surgery) or older or who have a serious medical illness such as heartdisease. If a decision is made to observe the tumor without treatment, an endocrinologist and an ophthalmologist may perform ongoing evaluations with CT or MRI scans. CT or MRI scans are performed three to six months after initial diagnosis and every six to 12 months thereafter until the situation has been clarified. This period of observation without treatment provides information that helps the doctors decide if it is necessary to use other treatments that have more risks.

TREATMENT WITH DRUGS

One type of pituitary tumor in particular can be successfully treated with drugs. This type of tumor secretes a hormone called prolactin and is called a prolactinoma. Prolactinomas often can be controlled by a drug called bromocriptine or a newer medication called cabergoline. These drugs most often cause a reduction in the tumor size and at the same time decrease an abnormally high prolactin level in the blood. Although bromocriptine or cabergoline may control the tumor, they may not cure it. Treatment with with these drugs often must be continued for many years at reduced levels; but, sometimes, the tumor may apparently disappear after a few years' treatment.

In most cases, bromocriptine is an effective treatment for prolactin-secreting tumors and has few side effects. However, some patients taking bromocriptine develop nausea, headache, dizziness and weakness. Usually these symptoms can be avoided by taking small doses of the drug at first and slowly increasing the dosage up to the needed level over a period of several weeks or months. Side effects are similar with cabergoline but not as common. Bromocriptine and cabergoline will not control all prolactin-secreting tumors. Approximately 20 percent of patients with prolactinomas may need surgery or radiation therapy.

There are other drugs that may aid in the control of tumors that produce excess growth hormone. These drugs are usually used only if surgery and/or radiation therapy fail to cure the tumor, or during the period while the patient is waiting for radiation therapy to take effect. However, if a patient prefers not to have surgery, drugs can sometimes be an effective alternative treatment.

RADIATION THERAPY

Another treatment option for pituitary tumors is radiation therapy. Radiation therapy is most commonly used after surgery. Most people think of radiation therapy as a treatment for malignant tumors. As previously mentioned, most pituitary tumors are benign tumors. However, some tumors have roots in the bone or coverings around the brain that involve vital nerves or blood vessels in such a way that surgical removal would cause significant damage to these important structures. In these cases, it is best to treat the main part of the tumor with surgery and to use radiation therapy for the roots or remaining tissue.

Radiation therapy, given under the direction of a radiotherapist, is most effective after surgery has reduced the size of the tumor.

The smaller the tumor at the time of radiation therapy, the more effective the radiation therapy. Radiation usually requires a series of treatments that last a few minutes each day for four to six weeks. In most cases, the treatment is painless and is done on an outpatient basis. Radiation treatments generally begin a few weeks or months after surgery to allow time for incisions from the surgery to heal.

The ability of the gland to produce hormones often decreases slowly after radiation therapy. Twenty percent of patients who have normal pituitary function soon after the radiation therapy ends will require hormone replacement after two years. This figure rises to 50 percent after five years.

A specialized form of radiation therapy called radiosurgery can be used in selected cases. Radiosurgery involves a single, highly focused radiation treatment. The patient often can return home after the single treatment, which is done on an outpatient basis.

SURGERY

Surgery is the preferred treatment for most pituitary tumors. Two types of surgeries are offered for pituitary tumor removal.

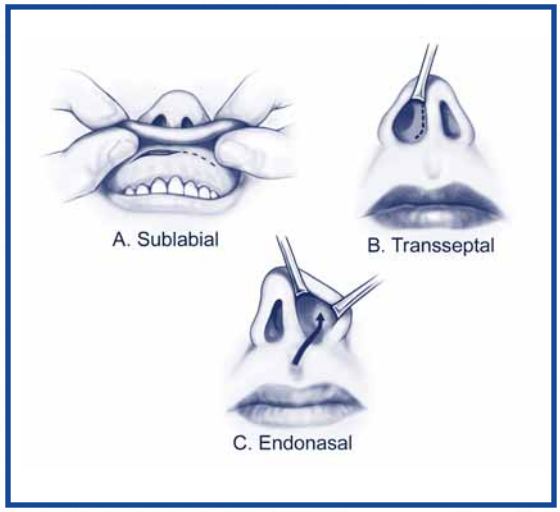

Figure 3: The endonasal procedure reduces operating room time and does not require an incision on the face.

TRANSSPHENOIDAL SURGERY

Most pituitary tumors are removed by the transsphenoidal method of surgery, which means the surgery is directed through the nose via the sphenoid bone and sphenoid sinus. The sphenoid is a small bone in the back of your nose and under your upper gum, located just below the pituitary gland. It often contains a large air filled cavity called the sphenoid sinus. In the past, the transsphenoidal procedure was begun by making a one-to two-inch incision under your lip at the top of your upper gum as shown in the sublabial modifications (see Figure 3A) or within the nose using the transseptal modification (See Figure 3B).

Endonasal Procedure: In recent years, the surgery has been modified so that there is no need for an incision under the lip or in the front part of the nose. The new procedure is called an endonasal procedure because the tumor is approached through the nasal cavity without an incision. There is no incision on the face.

The tumor is reached by working through one nostril and making a hole in the back of the nose (see Figure 3C) into the sphenoid sinus and through the layer of bone between the sphenoid sinus and the pituitary gland. The tumor is then removed. The endonasal procedure reduces operating room time by as much as two hours.

In the older approach, the incision in the mouth and the elevation of the mucosa from both sides of the nasal septum increased the length of time required to expose the tumor and to close the area after the tumor was removed. The larger incision in the mouth also slowed the patient's return to a normal diet and was associated with some risk to the upper teeth. The newer approach has proven to be just as effective in reaching the pituitary gland, and the benefits are greater. Patients can resume a normal diet soon after surgery, and facial swelling and risk of injury to the upper lip and teeth is markedly reduced. Since there is no need for packing the nose with gauze post-operative discomfort is decreased and many patients return home on the day after surgery.

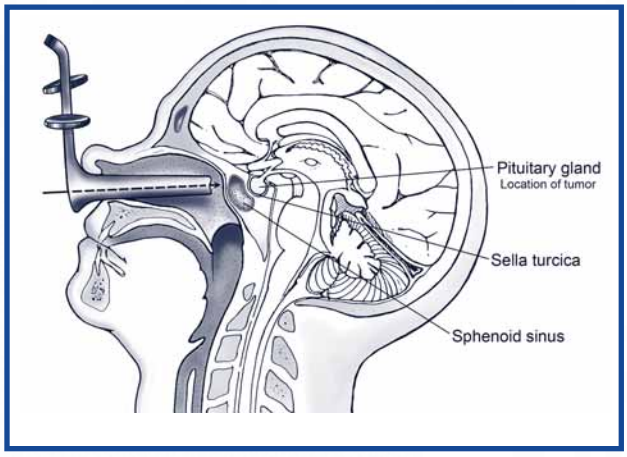

Figure 4: Site of the transsphenoidal operation. The surgeon works through the nostril and the tumor is approached through the sphenoid sinus.

Often, surgeons will remove a small piece of fat from just below the skin on the abdomen to fill the cavity created by the tumor removal. They will close the bottom of the skull with a piece of bone taken from the wall of the sphenoid sinus (see figure 4) or a piece of absorbable, man-made material. This will help prevent leakage of cerebrospinal fluid (CSF). The CSF fluid surrounds the brain, spinal cord, and pituitary gland and acts as a cushion, and provides nutrients for these structures.

In a small number of patients, the fat or muscle packing will not hold and CSF may leak from the nose. If the drainage continues, it may lead to the entrance of bacteria into the CSF and may result in an infection called meningitis. Sometimes waiting a few days, or treatment with a small drainage tube in the lower back, will allow this drainage to stop so that no further treatment is needed. However, in a few patients (less than 1 in 50), another procedure may be necessary to seal the opening at the base of the skull.

In the endonasal procedure, no stitches or gauze packings are needed to close the area since no incision is necessary.

CRANIOTOMY

The other surgery, called a craniotomy, is directed through the skull above the eye. The craniotomy operation involves making an incision on the scalp near the top of the head. A piece of bone then is lifted out and the coverings over the brain are opened.

The lower part of the brain is gently lifted to expose and remove the tumor. The piece of bone then is replaced and the scalp is closed with stitches or staples. In most cases, the incisions on the head can be placed so that the scar is hidden by the hair. This type of operation often is not needed for a pituitary tumor, but is sometimes necessary if the tumor is very large or it cannot be reached through the nose by a transsphenoidal operation.

RISKS OF SURGERY

Certain risks exist with both the craniotomy and the transsphenoidal surgery. With either method, there is a small risk of death, which occurs with any anesthesia and major surgery. This risk is less than one percent. With either operation, there is a risk of developing vision problems because the nerves to the eyes are located in the area of the tumor. If there has been a distinct loss of vision before the surgery due to pressure from the tumor, vision often is greatly improved by the operation. The degree of vision recovery after surgery depends on how much damage has been done to the nerves of the eye by the tumor beforehand. If the degree of visual loss is minor before surgery, there may be full recovery. On the other hand, if there has been a marked loss of vision before surgery, there often is improvement in vision, but not full recovery. Also, it is possible but uncommon for patients who have not had a visual problem before the operation to have this type of problem afterwards.

There is some risk that surgery may damage the pituitary gland. In many cases, pressure by the tumor already has damaged the gland. The chance of surgery damaging the gland is small if the tumor is small, however the risk increases when the tumor is large. In most cases, even with very large tumors, the gland regains normal functions after a recovery period.

Another risk is a condition called Diabetes Insipidus, which is caused by a decrease in antidiuretic hormone (ADH). A lack of this hormone leads to increased thirst and frequent urination. The pressure from a pituitary tumor or surgery may cause this problem. Diabetes Insipidus can be treated by replacing the antidiuretic hormone with medication. This usually is given in the evening to reduce the frequency of urination during the night. In most patients, Diabetes Insipidus goes away after a few days.

Other risks associated with surgery include double vision, numbness of the face, bleeding, infection, stroke, or other neurological problems.

PREPARING FOR SURGERY

At the initial evaluation, your physician will examine you and ask questions about your medical history. If surgery is needed, you will undergo preoperative evaluations. This evaluation often includes a general physical exam, EKG, chest X-Ray, selected blood tests and a visit with an anesthesiologist. It is important to know if your tumor is producing excess levels of growth hormone or ACTH.

The preoperative evaluation usually is completed in the clinic the day before surgery, but it can be performed several weeks in advance. Some of the tests can be done near your home if this is more convenient.

You will be admitted to the hospital on the day of your surgery. Do not eat or drink after midnight before surgery. After you arrive at the hospital, you will be taken to the preoperative "holding" room where intravenous fluids will be started and you will be given medication to help you relax. Then you will be taken to the operating room where the anesthesiologist will put you to sleep.

WHAT TO EXPECT AFTER SURGERY

After surgery, you will be transferred to the recovery room for several hours before being transferred to the intermediate or intensive care unit. You will remain there overnight. In each of these areas, you may be connected to one or more monitors so that the medical team can closely track your condition.

Because the pituitary gland is at the base of the brain, an important part of your care after the surgery includes frequent neurological checks by your doctors and nurses. You will be asked a series of questions that help determine how well your brain is functioning. These checks will include questions such as "What is your name?," "Where are you right now?," and "Can you tell me the date?" Doctors also will shine a light in your eyes and test the strength of your arms and legs. These checks are necessary to detect and monitor changes in your condition.

MONITORING YOUR FLUID BALANCE

As mentioned earlier in the booklet, your pituitary gland secretes a hormone called antidiuretic hormone (ADH), which regulates the fluid in your body. Surgery may decrease the amount of ADH circulating in the body. The decrease will cause the kidneys to release water from the body producing large quantities of diluted urine.

Also, the large loss of water from the body may cause dehydration, so you will need to consume more fluids.

As mentioned before, a deficiency in ADH is called Diabetes Insipidus. In most cases, this condition goes away by the time you leave the hospital. The nursing and medical staff will closely measure both fluid intake and output.

A catheter (rubber tube) will be inserted into your bladder during surgery for accurate measurement of urine output. It is usually removed the morning after surgery. After the catheter is removed, your urine will continue to be measured by having you urinate into a collection container (called a "hat"), which will be placed on the toilet in your bathroom. Therefore, it is important to keep an accurate count of everything you drink, as well as your urine output.

As your recovery progresses, you will continue to notify the nursing staff of everything you drink.

During the first one or two days, an intravenous tube will remain in place until the medical and nursing staff feel you are taking enough fluids by mouth. The intravenous tube also is used to give antibiotics that help protect against infections.

Patients with Cushing's disease – an ACTH-producing tumor – need careful measurement of serum cortisol in the days following surgery, as this will help to assess the success of the surgery in completely curing the condition.

YOUR DIET AFTER SURGERY

The nursing staff will keep fluids at your bedside and encourage you to drink when you are thirsty. Your initial diet after surgery will consists of clear liquids. You should avoid certain drinks that contain a lot of salt (such as Gatorade). You will be discouraged from using a straw as this increases the pressure in the surgical area. You will progress to your regular diet when you tolerate liquids well.

NASAL DRAINAGE

As mentioned previously, a small piece of muscle or fat is removed from just under the skin over the abdomen to "plug" the opening in the back of your nose. The medical and nursing staff will monitor the drainage from your nose. This is done by changing the pad covering your nose and checking the drainage for cerebrospinal fluid (CSF), which would indicate a leak (see Figure 5). You also will have a small dressing on your abdomen where the "plug" was removed. The stitches from this incision will dissolve by themselves and do not need to be removed.

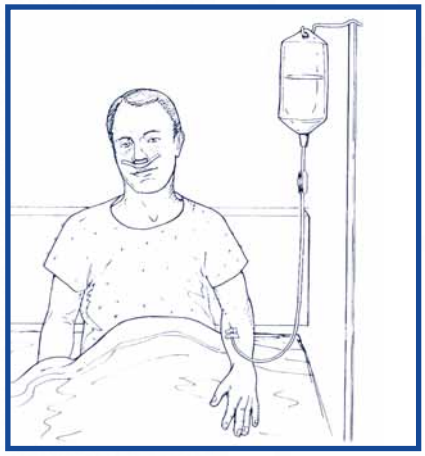

Figure 5: A pad is taped under the nose after the operation is completed. There is no incision on the face. An intravenous tube is in place for a day or two after the operation.

PAIN AFTER SURGERY

Usually, the severity of pain after surgery is relatively mild. You may experience a headache that can be treated with medication. You may have some bruising under your eyes and/or along the side of your nose for only a few days.

ACTIVITY

The head of your bed must remain in an elevated position to prevent swelling and to help you breathe easier.

While you are on bedrest right after surgery, you will wear special stockings to improve special stockings to improve circulation in your legs. When you begin to get out of bed, usually the day after surgery, you will require assistance from the nursing staff until it is safe for you to walk by yourself.

As with any major surgery using general anesthesia, it will be important to exercise your lungs to prevent complications. Deep breathing and the use of a device called an incentive spirometer will help keep your lungs expanded. Vigorous coughing or sneezing is discouraged to avoid an increase in pressure in the surgical area.

RECOVERING FROM YOUR SURGERY

In most patients, the body will adapt to the changing levels of antidiuretic hormone (ADH) and maintain a reasonable balance of fluids.

However, for a small number of patients, urine production remains too high. If this occurs, your doctors may begin temporary treatment with an injection of synthetic ADH. If the body continues to be unable to control urine production, you may need to take ADH hormone after you leave the hospital. If this occurs, you will probably be given a form of ADH, which can be taken as a nasal spray or a pill. Also, we will often recommend treatment with cortisone for several weeks after surgery.

During the weeks or months after surgery, you probably will need to repeat hormone tests and eye exams. These tests will be similar to the ones that were done before the surgery. Often these tests can be done by the doctors in your community. The endocrinologist will test how well the pituitary gland is functioning by checking hormone levels in the blood. If the levels are not high enough for everyday activities, the doctor may prescribe hormone replacement therapy.

The ophthalmologist will evaluate any changes in your vision after surgery. Frequently, after the pressure from the tumor is relieved, visual problems will improve.

DISCHARGE INSTRUCTIONS

During the first two weeks, you should avoid sneezing and using any inhalants that might irritate your nose. You may gradually increase your activity level over the next two weeks until you reach your previous activity level. Most patients should plan on taking approximately two or three weeks off from work, although some patients may return earlier.

If your tumor was small, you probably will not need any hormone replacement therapy after you are discharged from the hospital. Patients with decreased pituitary gland functions can still lead a normal life by taking medication each day to replace the normal hormones in the body. If your tumor was large, you may be given a medication called hydrocortisone, which helps protect the body from the effects of stress.

If you need hydrocortisone after discharge, you may be instructed to increase the dose if you are stressed by fever, infection, surgery, or other illness. You will receive specific instructions about how to take hydrocortisone before you leave the hospital.

Other medicines that may be needed for decreased pituitary functions are thyroid medications, estrogen or progesterone in the female, and testosterone in the male.

FOLLOW-UP CARE

You will have a follow-up appointment with your surgeon approximately six weeks after surgery; and, at that time, you will also be able to see a UF endocrinologist who specializes in pituitary hormones. Laboratory tests will be performed to check the hormone levels in your blood and urine. Some patients develop a low sodium level in the blood during the first week or two after surgery because the pituitary gland overcompensates by producing too much antidiuretic (ADH). The excess ADH causes the body to retain fluid, thus diluting the serum sodium to low levels. Treatment for this is fluid restriction and replacement of sodium, either by salt tablets or intravenously. For this reason, you will be asked to obtain several sodium or electrolyte levels after leaving the hospital. You will receive a prescription before you are discharged from the hospital that can be given to a laboratory in your home area.

FOLLOW-UP RADIATION THERAPY

The decision to use radiation therapy usually is made in the hospital after surgery or at the time of an MRI several months later. In most cases, a second follow-up appointment will be scheduled two to three months after your first follow-up. The MRI scan usually is repeated at this time and if there are visual changes to the tumor, you also will need to see the ophthalmologist. We may perform additional laboratory tests at this time and we will review your medications.

The fact that some pituitary tumors recur emphasizes the importance of follow-up visits with your doctors. Vision usually improves if it was affected and fertility improves in most patients who were infertile. Most patients with a pituitary tumor resume a normal life after treatment.

For additional information about pituitary surgery please visit our web site at www.neurosurgery.ufl.edu or call our office at 352.273.9000 with questions or to schedule a consultation.

ACKNOWLEDGEMENT

This material is selective and does not cover all the information about this topic. If you have any questions or need clarification of this material, Please call 352.273.9000. This information is not a substitute for the recommendations of your doctor.

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