



American
Association of
Neurological
Surgeons

STEREOTACTIC BRAIN BIOPSY

PATIENT INFORMATION

This resource, developed by neurosurgeons, provides patients and their families trustworthy information on neurosurgical conditions and treatments.

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Stereotactic Brain Biopsy is a common procedure that allows a neurosurgeon to diagnose a **brain lesion**. Performed in the operating room, the procedure involves the removal of a small piece of tissue, most commonly from the brain, but could include samples from the scalp, **blood vessels** or **dura mater** (the outermost membrane covering the brain). Typically, patients present with symptoms that require a physician to capture images of the brain. These images may reveal lesions of uncertain causes. In order to recommend treatment, a doctor may require a **brain biopsy** to obtain a specimen that a pathologist can review for an official diagnosis. In most cases, the neurosurgeon will use stereotactic equipment to localize the preferable site for the biopsy. This allows the neurosurgeon to map the brain in a three-dimensional coordinate system and select the appropriate target coordinates for guiding the biopsy needle.

Primary brain tumors affect almost 30,000 individuals each year, and **metastatic tumors** affect almost 200,000. The most common primary brain tumors are **glioma** and **meningioma**. Imaging studies, such as a magnetic resonance imaging (**MRI**), provide information about a tumor's location, size and relationship to surrounding structures. At times, it is supplemented by a magnetic resonance spectroscopy (**MRS**), which provides information about the chemical composition of the tumor. Additionally, **diffusion/perfusion-weighted imaging** provides information about the **blood and water flow through a tumor**.

However, the most definitive method to make a diagnosis is by obtaining a tissue sample. The decision as to whether a biopsy should be performed, as opposed to attempting to completely remove a tumor, is made with consideration of numerous factors and is done carefully by a neurosurgeon — often in consultation with other neuro-oncology colleagues. If it is decided that a biopsy is the best course of action to guide further treatment, then the safest and most accurate route to access the tumor is performed. The same principle applies to metastatic brain tumors, where the primary malignancy is not known or in a situation where a neurosurgeon suspects an infectious process and there is need for tissue to confirm the diagnosis.

About Stereotactic Surgery

Stereotaxis is the process by which neurosurgeons use MRI or CT imaging studies, targeted algorithms and a computer workstation to precisely locate and target a tumor or other lesion inside the brain. Previously, this was done by placing a metal frame on a patient's head. However, this has been largely supplanted by a system that uses small fiducial markers, about the size of a nickel, that are gently stuck to different parts of the scalp, providing reference landmarks. Systems that employ stereotaxis to facilitate neurosurgery procedures are known as **stereotactic navigation systems**, and since most of them use scalp fiducials rather than the old frame, they are referred to as **frameless stereotactic neuronavigation systems**. They are used in the operating room to facilitate neurosurgical procedures, such as a biopsy.

There are several frameless stereotactic neuronavigation systems available for use in neurosurgery procedures. They are manufactured by different biomedical engineering companies and are named differently. They all have comparable accuracy and efficacy and use largely the same principles to perform the task. Neurosurgeons use the system they are most familiar and comfortable with, and one that they can trust for accuracy and reliability. A stereotactic biopsy is performed in the operating room and usually under general anesthesia.

Technique

Once the patient is asleep, the head is secured and the fiducials on the scalp are registered by cameras into the computerized navigation system in the operating room. A minimal amount of hair is shaved and a small incision marked out. This area is meticulously cleaned and draped in a sterile fashion. An opening in the skull about the size of a quarter is made (burr hole) and the covering of the brain (the dura) is opened. A stereotactic biopsy needle, which is long and has a soft-nosed blunt tip, is introduced to the target using the neuronavigation system in order to guide it and biopsy samples are obtained.

These are examined in real-time by performing a frozen section analysis with a pathologist and then additional samples are obtained for permanent pathology studies. The final results take three to four days to allow for special stains to be completed, which enhances the accuracy of the diagnosis. After the incision is closed, a clean and dry dressing is applied, which is typically removed in two to three days. Hospitalization is short and, at most, requires an overnight stay. Some patients are treated on an outpatient basis. The sutures are removed in 10-14 days.

Indications

The most common ailments that may be diagnosed by a biopsy are **tumors**, infection (e.g. **abscess**), **inflammation** (e.g. **encephalitis**), **demyelinating diseases** (e.g. **multiple sclerosis**) or perhaps a **neurodegenerative disease** (e.g. **Alzheimer's disease**). The biopsy may help identify lesions that do not require surgical treatment or diagnose patients who are poor surgical candidates so they can pursue other appropriate therapies.

Benefits

A needle biopsy makes it possible for neurosurgeons to reach the deepest recesses of the brain, allowing them to obtain a specimen in order to make a diagnosis in a relatively safe manner. Hospitalization is short and, at most, requires an overnight stay. Some patients are treated on an outpatient basis.

Risks

The **risks** associated with a stereotactic biopsy include **intracranial hemorrhage** (approximately 1 percent), infection (< 1 percent) or the inability to obtain tissue to make the diagnosis (1 percent), which may require a repeat biopsy. For the most part, this is a safe and useful procedure, performed by neurosurgeons with exquisite planning and care, and can provide valuable information, guiding further treatment. State-of-the-art software and equipment assure a high level of accuracy with minimal risk to surrounding brain tissue.

Recovery

Following a brain biopsy, bandages may be placed over the incision sites and can be removed the following day. Patients may be observed for a specified time after the treatment before they go home, or they may be kept in the hospital overnight for observation. Some people experience minimal tenderness around the incision site. Most patients can return to their usual activities the following day.

Follow-up

The neurosurgeon, generally in consultation with colleagues from radiation oncology and medical oncology, will set up follow-up care and treatment based on the results of the biopsy. If an infection is suspected, consultation with infectious disease specialists is forthcoming.

The AANS does not endorse any treatments, procedures, products or physicians referenced in these patient fact sheets. This information is provided as an educational service and is not intended to serve as medical advice. Anyone seeking specific neurosurgical advice or assistance should consult his or her neurosurgeon, or locate one in your area through the AANS' Find a Board-certified Neurosurgeon online tool.