American Association of Neurological Surgeons

Spinal Tumors

Patient Information

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

For more patient resources from the American Association of Neurological Surgeons (AANS), visit www.aans.org/Patients.

A **spinal tumor** is an abnormal mass of tissue within or surrounding the **spinal cord** and/or **spinal column**. These cells grow and multiply uncontrollably, seemingly unchecked by the mechanisms that control normal cells. Spinal tumors can be **benign** (non-cancerous) or **malignant** (cancerous). Primary tumors originate in the spine or spinal cord, and **metastatic** or secondary tumors result from cancer spreading from another site to the spine.

Spinal tumors may be referred to by the region of the spine in which they occur. These basic areas are **cervical**, **thoracic**, **lumbar** and **sacrum**. Additionally, they also are classified by their location in the spine into three major groups: intradural-extramedullary, intramedullary and extradural.

Intradural-extramedullary

The most common of these types of tumors develop in the spinal cord's **arachnoid membrane (meningiomas)**, in the nerve roots that extend out from the spinal cord (**schwannomas** and **neurofibromas**) or at the spinal cord base (**filum terminale ependymomas**). Although meningiomas are often benign, they can be difficult to remove and may recur. Nerve root tumors are also generally benign, although neurofibromas may become malignant over time. **Ependymomas** at the end of the spinal cord can be large, and the delicate nature of fine neural structures in that area may complicate treatment.

Intramedullary: These tumors grow inside the spinal cord, most frequently occurring in the cervical (neck) region. They typically derive from **glial** or **ependymal cells** that are found throughout the interstitium of the spinal cord. **Astrocytomas** and ependymomas are the two most common types. They are often benign, but can be difficult to remove. Intramedullary **lipomas** are rare congenital tumors most commonly located in the thoracic spinal cord.

Extradural: These **lesions** are typically attributed to metastatic cancer or schwannomas derived from the cells covering the nerve roots. Occasionally, an extradural tumor extends through the **intervertebral foramina**, lying partially within and partially outside of the spinal canal.

Metastatic Spinal Tumors

The spinal column is the most common site for **bone metastasis**. Estimates indicate that at least 30 percent and as high as 70 percent of patients with cancer will experience spread of cancer to their spine.

Common primary cancers that spread to the spine are **lung**, **breast** and **prostate**. Lung cancer is the most common cancer to metastasize to the bone in men, and breast cancer is the most common in women. Other cancers that spread to the spine include multiple myeloma, **lymphoma**, **melanoma** and **sarcoma**, as well as cancers of the **gastrointestinal tract**, **kidney** and **thyroid**. Prompt diagnosis and identification of the primary malignancy is crucial to overall treatment. Numerous factors can affect outcome, including the nature of the primary cancer, the number of lesions, the presence of distant non-skeletal metastases and the presence and/or severity of spinal-cord compression.

Pediatric spinal tumors

Primary spinal tumors are rare in children and are challenging to treat. Incidence and outcome vary by subtype, a listing of which can be quite broad but include the following:

- **Osteoid Osteoma**
- **Osteoblastoma**
- **Osteochondroma**
- **Osteosarcoma**
- **Ewing Sarcoma**
- **Eosinophilic Granuloma**
- **Aneurysmal Bone Cyst**
- **Chordoma**
- **Mesenchymal Chondrosarcoma**
- **Giant-Cell Tumor Of Bone**
- **Fibrous Dysplasia**
- **Fibroma**
- **Angiosarcoma**
- **Hemangioma**

Unlike adults, children have not achieved complete skeletal growth, which doctors must take into account when considering treatment. Other factors to consider are spinal stability, surgical versus nonsurgical interventions and preservation of neurological function.

Incidence and Prevalence

Intracranial (brain) tumors account for 85 to 90 percent of all primary **central nervous system (CNS)** tumors. Primary tumors arising from the spinal cord, spinal nerve roots and **dura** are rare compared to CNS tumors that arise in the brain. Overall prevalence is estimated at one spinal tumor for every four intracranial lesions. About 10,000 Americans develop primary or metastatic spinal cord tumors each year.

Intramedullary tumors are rare, accounting for only five to 10 percent of all spinal tumors. Benign tumors such as meningiomas and neurofibromas account for 55 to 65 percent of all primary spinal tumors. Meningiomas most frequently occur in women between the ages of 40 and 70. Metastatic spinal tumors are the most common type of malignant lesions of the spine, accounting for an estimated 70 percent of all spinal tumors.

Causes

The cause of most primary spinal tumors is unknown. Some of them may be attributed to exposure to cancer-causing agents. Spinal cord lymphomas, which are cancers that affect **lymphocytes** (a type of immune cell), are more common in people with compromised immune systems. There appears to be a higher incidence of spinal tumors in particular families, so there is most likely a genetic component.

In a small number of cases, primary tumors may result from presence of these two genetic diseases:

Neurofibromatosis 2: In this hereditary disorder, benign tumors may develop in the arachnoid layer of the spinal cord or in the supporting glial cells. However, the more common tumors associated with this disorder affect the nerves related to hearing and can inevitably lead to loss of hearing in one or both ears.

Von Hippel-Lindau disease: This rare, multi-system disorder is associated with benign blood vessel tumors (hemangioblastomas) in the brain, **retina** and spinal cord, and with other types of tumors in the kidneys or **adrenal glands**.

Symptoms

Non-mechanical **back pain**, especially in the middle or lower back, is the most frequent symptom of both benign and malignant spinal tumors. This back pain is not specifically attributed to injury, stress or physical activity. However, the pain may increase with activity and is often worse at night. Pain may spread beyond the back to the hips, legs, feet or arms and may worsen over time — even when treated by conservative, nonsurgical methods that can often help alleviate back pain attributed to mechanical causes. Depending on the location and type of tumor, other signs and symptoms can develop, especially as a malignant tumor grows and compresses on the spinal cord, the nerve roots, blood vessels or bones of the spine. Impingement of the tumor on the spinal cord can be life-threatening in itself.

Additional symptoms can include the following:

- Loss of sensation or muscle weakness in the legs, arms or chest
- Difficulty walking, which may cause falls
- Decreased sensitivity to pain, heat and cold
- Loss of bowel or bladder function
- **Paralysis** that may occur in varying degrees and in different parts of the body, depending on which nerves are compressed
- **Scoliosis** or other spinal deformity resulting from a large, but benign tumor

Diagnosis

A thorough medical examination with emphasis on back pain and neurological deficits is the first step to diagnosing a spinal tumor. **Radiological tests** are required for an accurate and positive diagnosis.

- **X-ray:** Application of radiation to produce a film or picture of a part of the body can show the structure of the vertebrae and the outline of the joints. X-rays of the spine are obtained to search for other potential causes of pain, i.e. tumors, infections, fractures, etc. X-rays are not very reliable in diagnosing tumors.
- **Computed tomography scan (CT or CAT scan):** A diagnostic image created after a computer reads X-rays, a CT/CAT scan can show the shape and size of the spinal canal, its contents and the structures around it. It also is very good at visualizing bony structures.
- **Magnetic resonance imaging (MRI):** A diagnostic test that produces three-dimensional images of body structures using powerful magnets and computer technology. An MRI can show the spinal cord, nerve roots and surrounding areas, as well as enlargement, degeneration and tumors.

After radiological confirmation of the tumor, the only way to determine whether the tumor is benign or malignant is to examine a small tissue sample (extracted through a **biopsy** procedure) under a microscope. If the tumor is malignant, a biopsy also helps determine the cancer's type, which subsequently determines treatment options.

Staging classifies neoplasms (abnormal tissue) according to the extent of the tumor, assessing bony, soft tissue and spinal canal involvement. A doctor may order a whole body scan utilizing nuclear technology, as well as a CT scan of the lungs and abdomen for staging purposes. To confirm diagnosis, a doctor compares laboratory test results and findings from the aforementioned scans to the patient's symptoms.

Treatment Decisions

Treatment decision-making is often multidisciplinary, incorporating the expertise of spinal surgeons, medical oncologists, radiation oncologists and other medical specialists. The selection of treatments including both surgical and non-surgical is therefore made keeping in mind the various aspects of the patient's overall health and goals of care.

Nonsurgical Treatment

Nonsurgical treatment options include observation, **chemotherapy** and **radiation therapy**. Tumors that are **asymptomatic** or mildly symptomatic and do not appear to be changing or progressing may be observed and monitored with regular MRIs. Some tumors respond well to chemotherapy and others to radiation therapy. However, there are specific types of metastatic tumors that are inherently **radioresistant** (i.e. gastrointestinal tract and kidney): in those cases, surgery may be the only viable treatment option.

Surgery

Indications for surgery vary depending on the type of tumor. Primary spinal tumors may be removed through complete **en bloc resection** for a possible cure. In patients with metastatic tumors, treatment is primarily **palliative**, with the goal of restoring or preserving neurological function, stabilizing the spine and alleviating pain. Generally, surgery is only considered as an option for patients with metastases when they are expected to live 12 weeks or longer, and the tumor is resistant to radiation or chemotherapy. Indications for surgery include intractable pain, **spinal-cord compression** and the need for stabilization of impending pathological fractures.

For cases in which surgical resection is possible, **preoperative embolization** may be used to enable an easier resection. This procedure involves the insertion of a catheter or tube through an artery in the groin. The **catheter** is guided up through the blood vessels to the site of the tumor, where it delivers a glue-like liquid **embolic agent** that blocks the vessels that feed the tumor. When the blood vessels that feed the tumor are blocked off, bleeding can often be controlled better during surgery, helping to decrease surgical risks.

The posterior (back) approach allows for the identification of the dura and exposure of the nerve roots. Multiple levels can be decompressed, and multilevel segmental **fixation** can be performed. The anterior (front) approach is excellent for tumors in the front of the spine and effectively reconstructing defects caused by removal of the vertebral bodies. This approach also allows placement of short-segment fixation devices. Thoracic and lumbar spinal tumors that affect both the anterior and posterior vertebral columns can be a challenge to resect completely. Not infrequently, a posterior (back) approach followed by a separately staged anterior (front) approach has been utilized surgically to treat these complex lesions.

Recovery

The typical hospital stay after surgery to remove a spinal tumor ranges from 2 to 14 days, depending on the patient's case. A required period of post-surgery physical rehabilitation may involve a stay in a rehabilitation hospital for a period of time. In other cases, physical therapy may take place at an outpatient facility or at the patient's home. The total recovery time after surgery may be as short as three months or as long as one year, depending on the complexity of the surgery and the patient's overall health.

Outcome

Outcome depends greatly on the age and overall health of the patient and on whether the spinal tumor is benign or malignant, primary or metastatic. In the case of primary tumors, the goal is to remove the tumor completely, leading optimally to the potential cure of the malignancy. In the case of metastatic tumors, the goal is almost always palliative, with treatment aimed at providing the patient with an improved quality of life and possibly prolonged life expectancy.

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.