

surrounding subarachnoid space, and it is commonly used in urgent cases of suspected tumors when MRI is not available. Other tests may include an MRI of the spine and electroencephalography. LP is dangerous in the presence of increased ICP because of possible brainstem herniation after sudden release of pressure.

Definitive diagnosis is based on tissue specimens obtained during surgery. Occasionally, special techniques are required for determining the cell type. This period of waiting is one of anxiety for family members who are aware of the link between cell type and prognosis. Because of the location of some brain tumors (such as brainstem tumors), a biopsy is not possible and the diagnosis is made by imaging findings alone.

## **Therapeutic Management**

Treatment may involve the use of surgery, radiotherapy, and chemotherapy, depending on the type of tumor. The treatment of choice is total removal of the tumor without residual neurologic damage. Patients with the most complete tumor removal have the greatest chance of survival. Several surgical advances have allowed the biopsy and removal of tumors in areas previously considered too dangerous for traditional operative techniques.

Radiotherapy is used to treat most tumors and to shrink the size of the tumor before attempting surgical removal. The use of chemotherapy has emerged in the past decades with an increasingly important role, either in combination with surgery and/or radiation, or alone. The problems of treatment are compounded by the serious late effects of all three modes of therapy. Surgery can cause injury to important areas of the brain, especially when the surgeon is attempting to remove invasive tumors. Irradiation has serious long-term consequences, which may include tissue necrosis, secondary malignancies, endocrine dysfunction, and behavioral or intellectual deficits. For these reasons, the use of irradiation is deferred for as long as possible in young children. Proton radiation is now being used for treatment of brain tumors and provides a more focused beam of radiation that may reduce side effects ([Fleming and Chi, 2012](#)).

## **Nursing Care Management**