Central Nervous System Tumors: Treatment & Recovery

Marylyn Kajs-Wyllie RN, MSN, CNRN, CCRN
Clinical Nurse Specialist, Neurosciences
St. David's Medical Center
Austin, Texas

Objectives

- Discuss the various types of brain and spinal cord tumors
- Discuss present treatment strategies along with experimental therapies
- Discuss rehabilitation techniques for the patient recovering from the effects of a brain or spinal cord tumor

The Central Nervous System
Brain Tumor Factoids

- Incidence is rising; 9.5/100,000
- The causes are not known (genetic/environmental-petrochemicals, aerospace, trauma)
- Can occur at any age
- Slight predominance in males
- Symptoms depend on size and location
- Treatment depends on type, location and size
- Prognosis varies

Most commonly occurring tumors in the adult: meningioma, pituitary adenoma, astrocytoma/glioma, schwannoma

Neural Cells

- Neuron: main cell
- Supporting cells:
  - Astrocytes
  - Glia “glue”
  - Lymphocyte
  - Oligodendrocyte
    - Make up the myelin
  - Ependymal cells
    - Line the ventricles
Types/Classification of Brain Tumors

- Histologically from the cells & tissues from which they arise
- **Primary**- arise from tissues/structures inside the intracranial vault
- Intrinsic (inside) vs. extrinsic (outside)
- Congenital/Developmental
- Metastatic
- **Benign**: well differentiated, no necrosis, confined to specific tissue
- "malignant by location" = inaccessibility

Congenital/Development Tumors

- **Hemangioblastoma**
  - From embryonic vessels
  - Slow growing, vascular
  - Occurs in any lobe
- **Cranioopharyngioma**
  - From pituitary stalk
  - Benign, cystic
  - Recurs, rapid growing
- **Chordoma**
  - From embryologic tissue
  - In brain & spinal cord
  - Invasive, poor prognosis
  - Primarily in children
Extrinsic Brain Tumors (outside)

- **Meningioma**
  - 30% of primary brain tumors
  - Arise from arachnoid cells
  - Can invade bone or muscle
  - Damage is by compression
  - Usually benign (90%)
  - Encapsulated, slow growing
  - 13-40% recur within 5 years
  - There is a malignant variant
    - Atypical or anaplastic (10%) which grows rapidly, invades the brain, and may metastasize (usually the lung)

  Treatment: surgery, radiotherapy (for Grade 2&3), serial MRIs, modest activity for watchful/unresectable
  - In Hydroxyurea, Tamoxifen, RU486

- **Acoustic Neuroma**
  - aka schwannoma
  - Arises from schwann cells of CN 8 (vestibular/cochlear nerve)
  - Benign, slow growing
  - "malignant by location"
  - Occurs at age of 30-60
  - Right next to Facial nerve
Considered An Extrinsic Tumor

Treatment of Acoustic Neuromas
- Conservative
- Radiotherapy
- Surgery
  - Inner ear approach
  - Craniotomy
- Post op issues
  - Facial paralysis
  - NV, loss of hearing, balance
  - Vestibular rehab

Intrinsic Brain Tumors (inside)
- Glial tumors
  - Arise from astrocytes or oligodendrocytes
  - Graded based on the degree of malignancy & cell differentiation
    - Low Grades:
      - Astrocytomas account for 25% of all primary brain tumors
      - Grade 1: In children, less common in adults; very slow growing, long course; cystic; may advance to a higher grade
      - Grade 2=benign; cells well differentiated; in teens, young adults
      - Non contrast enhancing lesion
      - Ganglioma: mixed glial & neuronal tissue
High Grade Gliomas

- Grade 3&4: Glioblastoma Multiform (GBM) - most common
- Anaplastic astrocytoma, anaplastic oligodendroglioma
- Very malignant, very rapid proliferation of blood vessels, can hemorrhage
- Most common in 55-65 yo
- Contrast-Enhancing mass lesion (arise in white matter), surrounded by edema
- May be necrotic, cystic
- Median survival = 14 months (2 year survival is about 8%)

Treatment for Gliomas

- High grade are difficult to treat
- Surgery: partial vs total resection
  - Goals: obtain accurate Dx, reduce tumor burden, decrease mass effect, maintain CSF flow, decrease need for steroids, decrease risk of seizures, cure.
  - Survival: >80% with total resection vs 50% with partial
- Follow up with Chemotherapy
- Follow up with radiotherapy

Ependymoma

- Can be benign or malignant
- Slow growing
- 5-6%
- Arises from ependymal lining of the ventricles
- Found in childhood, adolescence or adults
- Tx: gross total resection
- Periodic CTs/MRIs to assess for "drop" mets
Pituitary Tumors

- Endocrine-Active (secreting) Tumors
  - aka macroadenoma
  - ACTH: Cushing’s disease (HTN, obesity, buffalo hump, moon face)
  - GH: gigantism, acromegaly

- Endocrine Inactive (Nonsecreting) Tumor (99%)
  - Chromophobe adenoma: decrease in pituitary function; get visual changes; loss of: libido, body hair, menses, ptosis

Removal of Pituitary Tumor

- Transphenoidal approach
- Endoscopic approach
- Tx: radiation in combo with Sx
- Stepped Sx approach, hormonal replacement

Nursing care Post Pituitary Tumor Removal

- Strict I&O; Monitor urine output
- DDAVP administration & other replacement drug therapy
- Specific gravity of urine
- Pain
- Monitor for CSF leak; post nasal drip, increased thirst
- Neurological assessment: visual acuity
- Discharge Teaching
Common Tumors which Metastasize to the Brain

- 1/4 pts via bloodstream
- *Small cell of the lung
- *Breast
- Skin (melanoma)
- Kidney (renal cell)

Treatment for Brain Metastasis (life expectancy is < 6 months)

- Diagnosis of type may be 1st done with a Bx
- Depends on one vs multi lesions
- If primary tumor is chemosensitive or radiosensitive
- Multi cranial lesions; no Sx, whole-brain XRT
- Single cranial lesion: surgery + whole-brain XRT
- Radioresistant tumors: renal cell, melanoma
- Chemotherapy: limited role in adjuvant therapy due to BBB, but treat primary tumor
- Chemosensitive tumor: breast
- Steroids
- Radiotherapy (Gamma Knife)
Specific treatment for Breast Mets

- Avoid estrogen receptor, progesterone receptor drugs
- Herceptin (Trastuzumab)=monoclonal antibody agonist (inhibitor therapy)
- Avastin

Brain Mets Treatment

- Primary: lung
- Tx was steroids, whole brain radiation
- 3 months follow up

Melanoma

- Treatment: surgery (for single lesions)
- Are radioresistant
- Gamma Knife and LINAC have been shown to be successful
Common Pathophysiology of Brain Tumors

- **Invasion**: grows until meets rigid structure; changes contour
- **Infiltration**: infiltrates tissue spaces as multiple cells without mass effect
- **Compression**: increase in size; cell proliferation or necrosis; fluid accumulation, hemorrhage or accumulation of by-products
- **Result in**:
  - Cerebral edema in areas of tumor; vasogenic, alterations in BBB
  - Increased ICP
  - Focal neurological deficits; compression/stretching of CNs 3,4,6; compression of blood vessels

Common assessment findings

- Nonspecific: Headache (50%); ICP: N/V.
- Seizures (25%-50%); generalized or partial
- Specific S&S depend on tumor location & rate/extent of growth
- Lateralizing signs: hemiparesis, aphasia, visual field deficits (50%)
- Stroke-like symptoms due to hemorrhage into tumor

S&S based on Function of the Lobes

- **Frontal**
  - Movement, intelligence, reasoning, behavior, memory, personality
- **Parietal**
  - Intelligence, reasoning, telling right from left, language sensation, reading
- **Occipital**
  - Vision
- **Temporal**
  - Speech, behavior, memory, hearing, vision, emotions
- **Cerebellum**
  - Balance, coordination, fine muscle
- **Brain stem**
  - Breathing, BP, HR, swallow

Pituitary
- Hormones, growth, fertility
Diagnostic Evaluation

- Skull x-rays
  - Determine bone involvement
  - Identify pineal shift
- EEG
  - Localizes seizure focus
- CT/MRI
  - With and without contrast
  - Use of gadolinium
  - Identifies type, midline shift, cerebral edema
- Angiogram
  - Used to identify visualization of tumor

Management of Brain Tumors

Initial Management of Increased ICP

Intracranial Dynamics

- Monro-Kellie Doctrine
  - Brain surrounded by nondistendable bone & meninges
  - Balance among volumes of content of cranial vault:
    - As volume of one compartment increases, volume of another must decrease or else ICP occurs
Compensatory Mechanisms

- Displacement of CSF into spinal SAS
- Increased absorption of CSF, decreased production
- Decrease in CBF by displacement of venous blood to sinuses

After a certain level of compensation has occurred, a state of decompensation with resulting IICP occurs.

Factors influencing Ability to Compensate for IICP

- Location of lesion
- Rate of expansion of mass or new volume
- Impaired CSF drainage
- Intracranial compliance

Cause of IICP: Increase in tissue volume

- Neoplasm
  - May be slow, steady increase
  - Moderate increase with more malignant tumor
  - Sudden increase if hemorrhage occurs within tumor

- Cerebral Edema
  - Interstitial
  - Vasogenic
  - Cytotoxic
Cerebral Edema

- Two major types
  - Vasogenic
    - Most common
    - From breakdown of BBB
    - Causes: brain tumor, HTN
    - Steroids are Tx of choice
  - Cytotoxic
    - Swelling of all brain cells by some toxic factor (global)
    - Causes: hypotension, lactic acid, anoxia, seen in trauma
    - Steroids are not effective
- May be concurrent

Increase in Blood or Tissue Volume: Brain Swelling vs. Cerebral Edema

- Brain swelling: increase in Cerebral blood volume from vascular congestion (hyperemia)
- Cerebral edema: increased in the water content of the brain tissue
- Most increases in CBV are due to brain swelling
- Cerebral edema is a more delayed result
- Maximum level at 24-72 hours
- Subsides in 2 seeks, but may persist for mths
Reduction of Brain Volume

- Diuretics
  - Osmotic:
    - Mannitol 20-25%
    - Goal: serum osmo 320
  - Loop:
    - Reduces CSF production
    - Lasix
    - Maintain euvoletic state

Glucocorticoids

- Mechanism not clearly understood
- Repairs leaky junctions in the cerebrovasculature
- Results in repair of BBB
- Response: within hours to days
- Dosing: lowest dose to achieve desired result, based on CT & clinical information
- Oral or IV; 16 mg/day is common dose
- Every 6 hrs, then taper
- Decadron IV most commonly used

Medical Management

- Dexamethasome (Decadron)
  - Primary drug to decrease cerebral edema
  - Reduces radiation edema

- Antiepileptic drug therapy
  - Not prophylactic ally but only if present with Sz
Surgical Removal/Debulking

- Remove as much as possible without affecting underlying tissue (sub total resection)
- Concerns if tumor located on dominant hemisphere and on motor strip
- If large, biopsy to prevent “seeding” into the leptomeninges and for diagnosis

Chemotherapy

- May be given as primary treatment for low grade glioma or for recurrence
- Adjunctive therapy to surgery & radiation
  - Gliadel wafer: targeted chemo of 3.6% BCNU; controlled, sustained release directly to residual tumor cells; implanted at time of surgery; biodegrades over 2-3 weeks. Results: 6 month survival rate increased for pts treated with wafers to 56%, prolonged survival by 33% in conjunction with surgery
  - Inarterial chemotherapy: done under fluoroscopy via arterial catheters; delivers nontoxic dose; goes directly to tumor bed; total of 3 doses

Chemotherapeutic Regimens for Gliomas
(non targeted)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCNU</td>
<td>200 mg</td>
<td>IV q8wk</td>
</tr>
<tr>
<td>Temodar</td>
<td>150-200 mg</td>
<td>Po on days 1-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repeat cycle q 28 days</td>
</tr>
<tr>
<td>CCNU</td>
<td>110 mg</td>
<td>Po on day 1</td>
</tr>
<tr>
<td>Standard: CCNU</td>
<td>110 mg</td>
<td>Po on day 1</td>
</tr>
<tr>
<td>Procarbazine</td>
<td>60 mg</td>
<td>Po on days 8-21</td>
</tr>
<tr>
<td>Vincristine</td>
<td>1.4 mg (max 2mg)</td>
<td>IV on days 8 &amp; 29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repeat q 6-8 wks for 6 cycles</td>
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Radiation Therapy

- **Total Brain XRT:**
  - 6000 rad normal dose for glioma
  - External radiation to tumor bed with 2 cm border
  - Used for malignant tumors, in conjunction with subtotal resections, multiple tumors, for non-resectable tumors
  - Effects: produces free radicals which destroy DNA
  - Major toxicities: N/V, diarrhea, cramping, skin reactions, cerebral edema, headache, memory loss

Radiation Therapy (con’t)

- Specific syndromes related to XRT:
  - Somnolence syndrome (occurs 1-3 mths after Tx)
  - Radiation encephalopathy (dev. 2+ yrs after Tx)
  - Mineralizing microangiopathy (occurs 10mths-2 yrs)
  - Radiation necrosis (occurs 6mths-3yrs after Tx)
“Less toxic” Radiation Therapies

- Brachytherapy: interstitial radiation therapy
  - Radioactive pellets implanted in catheters close to tumor
  - Burn themselves out; removed in a few days, months or longer
  - Desired effect: necrosis to only tumor
  - Hemorrhage is a complication

- Radiosurgery: Linear Accelerator, Gamma Knife

Linear Accelerator (LINAC)

- Treats both small & very large tumors over time during cell division
- Called “fractionated”
- Collimators that modulate radiation beam
- Multi sessions, small doses to not damage healthy brain tissue
- For both metastatic and primary brain tumors
- Standard dose: 60 Gy in 30-33 fractions

Gamma Knife Radiotherapy

- “Knifeless biopsy”
- Tumors treated: brain mets, craniopharyngioma, glioma, meningioma, pituitary adenoma, hemangioblastoma
- Focused beams of radiation
  - This principle of intersecting beams of radiation means that only the target receives radiation and nearby, normal brain tissue is spared from harmful radiation.
Gamma Knife unit houses 201 cobalt sources

Collimator focuses beam onto the target

Brain Metastasis

Pre treatment

Post Treatment 8 months

Meningioma

Pre

Post
Acoustic Neuroma

Summary: Specific Treatment based on Tumor Type

- **Meningioma**
  - Surgery for complete removal or partial dissection
  - Radiation if complete removal not possible
  - Prevent complications of DVT (76%), PE (24%)
  - May “metastasize” outside CNS to lungs, liver

- **Astrocytoma (low grade)**
  - 1st brain tumor removal was in 1879
  - Surgery (complete removal rarely possible)
  - Radiation for Grade II if residual tumor

- **Glioblastoma multiforme**
  - Standard Tx: surgical debulking, radiation (4000-7000 rads over 4-8wks-cobalt and neutron beam), oral chemotherapy Temador

Current Research for Brain Tumors

- No treatment breakthroughs due to brain’s poor capacity for self repair, susceptibility of adjacent brain to damage from compression; limitation of surgical resection; restriction of radiation dose to brain; limited chemotherapeutic agents (do not cross BBB)
- Majority of research is for Tx of GBM
  - BBB disruption: opening up BBB with Mannitol/dye prior to instillation of BCNU; once every 4 weeks for total of 6 treatments
  - Future studies must focus on using multiple modalities for local control of primary brain tumors and other possible formulations i.e. Beads, gel, mesh, rods
Targeted Chemotherapy in Malignant Glioma

- **Molecular targeted therapy**
  - Selected binding of a drug to tumor cells
  - Recognizes either the molecules on the surface of a cancer cell or the signals the cancer cell sends out and disrupts several growth factor pathways
  - Epidermal Growth Factor Inhibitors
  - Anti-angiogenesis agents (neoangiogenesis is a hallmark of malignant glioma): monoclonal antibodies, *Avastin*
  - Tamoxifen: in high doses acts as a protein kinase C inhibitor

Future Research

- Venom from the giant yellow Israeli scorpion
  - TM-601 is a version of a peptide (Chlorotoxin)
  - Crosses BBB & binds to a lipid on the tumor cell
  - Combined with isotope 131
  - Administered into tumor
  - In Phase II trial

Brain Tumor Research

- <8% of adults with malignant brain tumors enroll in a clinical trial
- **Gene Therapy**: US Human Genome Project; mapping DNA; using genes for cancer: replace or supplement a defective gene or to bolster immune system or use like a drug
- High dose chemo with Bone marrow rescue
- Photodynamic therapy: uses a photoactive drug (Photofrin) and light from a laser to destroy cancer cells while limiting damage to health tissue
Other Research Treatments

- **Hypoxic cell sensitizers:** The goal of this approach is to make tumor cells more sensitive to radiation.
- **Immunotherapy:** The goal of immunotherapy is to stimulate the body's immune system to more effectively fight the brain tumor. Vaccines that have been developed against brain cancer cells are being tested. In some studies they seemed to slow the rate of progression of malignant gliomas.

Rehabilitation and Recovery After Brain Tumor Treatments

- **PT/PT** for arm or leg weakness
- **SLP** for swallow or cognitive or speech
- Radiation therapy may be started while in acute rehab
- May be tapering off steroids
- Fatigue is common
- Support: The American Cancer Society. The American Brain Tumor Association

### Karnofsky Performance Status Scale Definitions

<table>
<thead>
<tr>
<th>Rating (%)</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>100</td>
<td>Able to carry on normal activity and to work; no special care needed.</td>
</tr>
<tr>
<td>90</td>
<td>Normal no complaints; no evidence of disease.</td>
</tr>
<tr>
<td>80</td>
<td>Able to carry on normal activity; minor signs or symptoms of disease.</td>
</tr>
<tr>
<td>70</td>
<td>Normal activity with effort; some signs or symptoms of disease.</td>
</tr>
<tr>
<td>60</td>
<td>Cares for self; unable to carry on normal activity or to do active work. Requires occasional assistance, but is able to care for most of his personal needs. Requires considerable assistance and frequent medical care.</td>
</tr>
<tr>
<td>50</td>
<td>Requires special care and assistance.</td>
</tr>
<tr>
<td>40</td>
<td>Disabled; requires special care and assistance. Severely disabled; hospital admission is indicated although death not imminent. Very sick; hospital admission necessary; active supportive treatment necessary. Moribund; fatal processes progressing rapidly.</td>
</tr>
<tr>
<td>30</td>
<td>Dying</td>
</tr>
<tr>
<td>20</td>
<td>Moribund; fatal processes progressing rapidly.</td>
</tr>
<tr>
<td>10</td>
<td>Moribund; fatal processes progressing rapidly.</td>
</tr>
<tr>
<td>0</td>
<td>Dead</td>
</tr>
</tbody>
</table>
Prognosis (for malignancies)

- Related to grade, age, overall condition at Dx
- Anaplastic astrocytoma = 3yrs
- Glioblastoma multiforme = 1 year
- Astrocytoma/oligodendroglioma = 5-10 years

Case Study

- 24 yo with c/o HA since age 10
- Fell off roof, fractured right ulnar
- During w/u in ED, CT showed cerebellar mass
- Dx. Ganglioglioma
- Tx: decadron, posterior fossa surgery for complete removal of tumor in cerebellar vermix
- Post op: to ICU, then neuro floor then outpatient rehab
- Recovery: acute NV, diplopia, ataxia
Central Nervous System Tumors

Spinal Cord Tumors

Incidence

- More common in adults aged 20-65 years
- 60% have benign lesions
- 20% are gliomas and sarcomas
- Cause is unknown (unless metastasis)
- Many are considered primary

Location

- Thoracic 50%
- Lumbar 25%
- Cervical 20%
- Cauda equina 5%
Spinal Cord Tumors

- Ependymoma
- Astrocytoma
- Oligodendroglioma
- Hemangioblastoma
- Teratoma, epidermoid, dermoid, lipoma
- Metastases

Originate from….

- Intradural/extramedullary
  - Pia-arachnoid
  - Denticulate ligament
  - Spinal roots
  - Inner surface of dura
- Originate within dura but outside of cord
- Benign
- May be multiple sites: more common in lumbar region
- Types:
  - Schwannoma (most)
  - Neurofibromatosis
  - Meningioma
Intramedullary

- Within the cord
- Types:
  - Ependymoma
  - Astrocytoma

Extradural (epidural)

- Originates between periosteum and dura
- Develops in surrounding bone
- Produces destruction of vertebral bodies
- Types:
  - Metastatic
  - Meningioma
  - Lymphoma

Classifications of Spinal Cord Tumors
Neurilemmoma & Neurofibroma

- Most common (25%)
- Majority intradural & extramedullary
- Occur frequently in thoracic, then cervical, lumbar
- Occurs in 4th or 5th decade
- Causes nerve root S&S early
- Aka schwannoma
- Tx: total resection, unresponsive to radiation therapy

Meningioma

- 2nd most common (20%)
- Occurs anywhere in SC; 2/3 in thoracic
- Majority intradural & extramedullary
- Progressive, slow growing non-malignant
- 1st involves motor tracts
- Tx: operative excision, unresponsive to radiation therapy

Ependymoma

- 12% of all SC tumors
- Most common: cauda equina type (50%)
- Localizes to lumbar, sacral, conus medullaris & filum terminale of cord
- 40% totally intramedullary
- Common S&S: pain & weakness of limb, bladder sphincter disturbances
- Tx: total excision (easy to dissect), radiation and intrathecal methotrexate for non resectable tumors
Astrocytoma

- Less common
- Both benign & malignant types
- Intramedullary
- S&S uni or bilateral paresis, sensory loss, sphincter disturbance
- Tx: bony decompression, aspiration of cysts, xrt, bulk resection (not totally resectable)

Metastatic Tumors

- 50%; 50-70 yr age group, men more than women
- Most common Mets to spine is epidural in thoracic spine; spreads via venous or lymphatic system
- Primary sites: lung, breast, prostate, kidney
- Primary lesions usually sarcoma, lymphoma
- Clinically short Hx: root pain, back pain progressive long tract involvement
- Tx: When primary tumor known: steroids, XRT when motor weakness present & progressing: decompressive laminectomy followed by xrt after incision heals; sometimes palliative Tx only

Mets:
lays on outside of SC, rarely invasive (into SC), fast growing, pathology = cord compression or erosion of vertbra
Lipoma

- Frequently associated with spina bifida
- Intradural & extradural
- May be clinically silent
- Difficult to distinguish from normal tissue

Hemangioblastoma

- Majority intramedullary
- Symptoms benign in thirties
- Malignant but not fatal
- Well seen on angio
- T1-weighted images - Isointense signal to spinal cord
- T2-weighted images - Hyperintense signal
- Cystic with tumor nodule (50-70%)
- Enhances strongly with contrast
- Extramedullary extension in 15%

Dermoid & Epidermoid Cysts & Teratoma

- Congenital
- Lumbosacral origin associated with s. bifida
- Benign
- Well-defined, pearly, cheesy, cystic
- Tx: subtotal resection (can recur)
Pathophysiology

- **Cord compression**
  - SC poorly tolerates expanding lesion
  - SC responds to pressure by swelling
  - SC parenchyma is destroyed
  - Nerve roots are damaged & spinal vessels occluded

- **Direct Pressure (affects circulation)**
  - Interferes with spinal root & cord conduction
  - Impairs circulation of spinal veins
  - Produces ischemia and myelitis
  - SA compression results in CSF pressure

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Diagnostics

- Spine x-rays or tomograms
  - Identifies narrowing
  - Destruction of vertebrae
- LP: dry tap may mean block
- Spinal angiography
  - For vascular lesion
- EMG
- MRI
- CT : to search for mets

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Progression of Symptoms

- Usually gradual
- Disturbed motor function often 1st sign
- Spasticity
- Sensory impairment below lesion
- Oppenheim's stages of SC compression:
  - Root pain and segmental sensory or motor disturbances
  - Brown-Sequard syndrome
  - Complete transaction
Stages of Spinal Cord Compression

- Early stage
  - Localized back pain, Radicular pain

- Intermediate Stage
  - Muscle weakness, paresthesias, ataxia, bladder dysfunction, decreased pain/temp sensation

- Late Stage
  - Paralysis, loss of sphincter control

- Suspicious findings
  - Hx of cancer, pain that is worse when pt is supine, improves when sitting

Treatment

- Surgery
  - Complete or partial resection depending on type and location of tumor
  - Decompression of bony structures to provide more room
  - Cordotomy or palliative sectioning of sensory roots for intractable pain

- Radiation
  - Highest tolerable dose depends on length of cord and age of patient
  - Whole length of cord generally tolerates 400 rads over 5 week course

The Role of Chemotherapy in SC Tumors

- Chemotherapy. A standard treatment for many types of cancer, has not proved beneficial for most spinal tumors

- Two Trials:
  - Tamoxifen: RATIONALE: Drugs used in chemotherapy, such as carboplatin and topotecan, work in different ways to stop the growth of tumor cells, either by killing the cells or by stopping them from dividing. Tamoxifen may help carboplatin work better by making tumor cells more sensitive to the drug.
  - PURPOSE: This phase II trial is studying the side effects of giving carboplatin and topotecan together with tamoxifen and to see how well it works in treating patients with central nervous system metastases or recurrent brain or spinal cord tumors.

  - Peripheral stem cell transplantation: RATIONALE: Drugs used in chemotherapy use different ways to stop tumor cells from dividing so they stop growing or die. Combining chemotherapy with peripheral stem cell transplantation may allow the doctors to give higher doses of chemotherapy drugs and kill more tumor cells.
  - PURPOSE: Phase I trial to study the effectiveness of combination chemotherapy plus peripheral stem cell transplantation in treating infants with malignant brain or spinal cord tumors.
Rehabilitation

- Prevention of complications of immobility
- Prevention of bowel & bladder dysfunction
- Long-term rehab
  - Physical
  - Psychosocial

Factors associated with a Favorable Outcome in SC compression

- Intact sphincter control
- Intact motor and sensory function
- Gradual onset of symptoms (>72 hrs)
- Non pulmonary primary tumor
- Distal lesion of spinal column

Recovery

- Due to possible muscle weakness, changes in balance, and other considerations, the following adjustments, among others, may help make the home a safer place for the patient with a CNS tumor:
  - Consider putting handrails in shower and bathtub.
  - Consider getting a shower chair.
  - If the home is more than one story, consider putting the patient’s bed on the ground floor.
  - Consider getting a hospital bed.
  - Consider getting a portable toilet.
  - Make sure the patient has adequate support from family members, friends, or home care aids if he/she is not able to be left alone.
Case Study

- 68 yo male with progressive right leg weakness, spasticity with adduction, brown Sequard: no strength right quad, some hamstring, areflexic; no sensation on left; normal upper extremities

Case Study: Tx and recovery

- MRI Spine: Intramedullary mass from T9-11
- Paraplegic or quadriplegic? What would be the standard treatment/Nursing Care?
- Treatment: 11hr back surgery with removal of ependymoma; hospitalized x 4 weeks, then to rehab

Mr. C.

- 44 yo white male with “carpal tunnel syndrome” for many yrs; chiropracter for “pinched nerve”
- Increased numbness/weakness in arms, 2/5 deltoids, 3-5/5 biceps, 5/5/ triceps, 4/5 left wrist, 3/5 right wrist; diminished light touch throughout arms (+) proprioception, stiff gait
- MRI: 6mm enhancing lesion from C2-3 Level to T3
Ms P

- 87 yo female with C/O left lower extremity progressive weakness,
- Exam: bilateral clonus, brisk reflexes, left foot with inversion
- MRI: intradural mass extending through the foramen at C6-7 with intraspinal extension, C7 severe central stenosis
- Tx: laminoplasty with plates; total resection of schwannoma
- Post op: PT/OT, mobilization, brace to left foot, initiation of bowel program, transfer to inpt rehab 2nd day post op

References