The presenters have no conflict of interest to report regarding any commercial product/manufacturer that may be referenced during this presentation.

Objectives

• Understand:
  – Types and symptoms of primary and metastatic CNS tumors
  – Medical treatments and procedures
  – Precautions and contraindications
  – The cancer continuum and its impact on function and rehabilitation
  – Rehabilitation interventions and determine discharge needs
CNS Tumor Characteristics

• Can be:
  – Benign or malignant
  – Primary or metastatic
• Prognosis depends on:
  – Type and grade of tumor
  – Location
  – Age
  – General health and functional status

CNS Tumor Risk Factors

• Hereditary diseases
• Disorders of the immune system
• Ionizing radiation
• Prior history of cancer (metastatic CNS disease)

Incidence of Oncology CNS Cases¹

< 1% chance that an individual will develop a malignant CNS tumor in his/her lifetime

<table>
<thead>
<tr>
<th></th>
<th>Estimated New Cases for 2013</th>
<th>Estimated Deaths for 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both Sexes</td>
<td>23,130</td>
<td>7,930</td>
</tr>
<tr>
<td>Male</td>
<td>12,770</td>
<td>6,150</td>
</tr>
<tr>
<td>Female</td>
<td>10,360</td>
<td></td>
</tr>
</tbody>
</table>
Brain Tumors

- Primary brain tumor types
- Metastatic brain tumors
- Symptoms
- Medical interventions

Primary Brain Tumor Types

- Most common primary brain tumors in adults:
  - Meningioma
  - Astrocytomas
  - Oligodendrogliomas
  - Schwannomas
  - Primary central nervous system lymphomas (CNS lymphoma)

<table>
<thead>
<tr>
<th>Primary Brain Tumors in Adults</th>
<th>Meningiomas</th>
<th>High Grade (3 &amp; 4) Astrocytomas (Anaplastic astrocytoma and glioblastoma)</th>
<th>Low Grade (1 &amp; 2) Astrocytomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin</td>
<td>Membranes lining the skull, covering the brain</td>
<td>Supportive cells of the brain (astrocytes)</td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td>Affect twice as many women as men; very rarely spread</td>
<td>Grow rapidly and invade nearby tissues</td>
<td>Slow growing</td>
</tr>
<tr>
<td>Treatment Approaches</td>
<td>Often curable with surgery</td>
<td>Surgery, radiation, and chemotherapy</td>
<td>Surgery or radiation</td>
</tr>
<tr>
<td>Incidence</td>
<td>Account for 27% of primary brain tumors</td>
<td>Account for about 25% of primary brain tumors</td>
<td>Less than 10% of primary brain tumors</td>
</tr>
</tbody>
</table>
Primary Brain Tumors in Adults:

<table>
<thead>
<tr>
<th></th>
<th>Oligodendrogliomas</th>
<th>Schwannomas (Acoustic Neuromas)</th>
<th>CNS Lymphomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin</td>
<td>Oligodendrocytes</td>
<td>Schwann cells of vestibulocochlear nerve</td>
<td>Lymph tissue of brain, spinal cord, meninges, eye</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Often occur in frontal or temporal lobe; can be low grade or high grade</td>
<td>Benign tumor and usually very slow growing</td>
<td>Develops in people with compromised immune systems</td>
</tr>
<tr>
<td>Treatment approaches</td>
<td>Surgery, radiation, and chemotherapy</td>
<td>Surgery and radiation</td>
<td>Chemotherapy and/or radiation</td>
</tr>
<tr>
<td>Incidence</td>
<td>Less than 3% of primary brain tumors</td>
<td>Account for 7% of all CNS tumors</td>
<td>Account for 2% of primary brain tumors</td>
</tr>
</tbody>
</table>

Anaplastic Astrocytoma

Acoustic Neuroma
Metastatic Brain Tumors

• 10x more common than primary brain tumors
• Cancers originating in the lung, breast, colon, kidney, along with malignant melanoma, are most likely to metastasize to brain
• 5% to 25% of cancer patients will develop brain mets
• About half of patients with brain metastases will have multiple brain lesions
• Typically associated with a poor prognosis; median survival < 6 months

Metastatic Colon Cancer to Brain

Brain Tumors

• General symptoms / presentation
  – Headache
  – Seizures
  – Nausea and vomiting
  – Neurological dysfunction (hemiparesis, visual field cut, sensory loss, aphasia)
  – Cognitive / behavioral changes
  – Site specific focal symptoms
Medical Interventions for Brain Tumors

- Surgical procedures
  - Biopsy
  - Craniotomy
  - VP shunt
  - Ommaya reservoir
- Radiation
- Chemotherapy
- Corticosteroids

Surgery

- Types
  - Biopsy
    - Surgical removal of a sample of tumor tissue
  - Craniotomy
    - Incision made in skull
    - Removal of skull (bone flap) overlying tumor
    - Resection of tumor
    - Replacement of bone flap

Surgery

- Goals:
  - Provide a tumor sample to establish an accurate diagnosis
  - Remove as much of the tumor as possible
  - Relieve seizures
Ventriculoperitoneal Shunt (VP Shunt)
• Shunt placed to relieve blockage or excess fluid
• Relieve intracranial pressure

Ommaya Reservoir
• Used to:
  – Obtain samples of CSF used to find cancer cells or infection in lining of brain
  – Deliver chemotherapy and antibiotics into the CSF

Radiation Therapy
• Types:
  – Whole Brain Radiation Therapy (WBRT)
  – Stereotactic Radiation Therapy
  – Intensity Modulated Radiation Therapy (IMRT)
  – Image-Guided Radiation Therapy (IGRT)
• Indications:
  – After surgery to destroy any remaining tumor cells
  – To treat tumors that cannot be surgically removed and for metastatic brain tumors
  – To relieve symptoms
Radiation Therapy

- Possible side effects:
  - Fatigue
  - Nausea
  - Vomiting
  - Decreased cognition and memory
  - Radiation necrosis

Chemotherapy

- Blood brain barrier
- Methods of delivery
  - Systemic
    - Oral
    - IV
  - Local
    - Wafers
    - Ommaya reservoir

- Possible side effects:
  - Fatigue
  - Headaches
  - Nausea
  - Vomiting
  - Infection
  - Easy bruising or bleeding
  - Peripheral neuropathy
Corticosteroids (Decadron)

- Decrease edema around the tumor
- Improve neurological symptoms
- Help relieve pre-surgery symptoms such as headache
- Used following surgery or radiation
- Used for recurrent or metastatic brain tumors

Corticosteroids (Decadron)

- Common side-effects
  - Proximal muscle weakness / wasting
  - Osteoporosis
  - Weight gain
  - Hyperglycemia
  - GI problems
  - Insomnia and mood changes
  - Decreased immune response

Spinal Cord Disease
Spinal Cord Disease

- Characteristics and symptoms
- Spine tumor types
- Medical interventions and general precautions

Spine Tumor Characteristics

- Growing tumors cause spinal cord compression
- Location of the lesion in spinal cord determine symptoms
- Severity of symptoms does not correlate with tumor size
- Primary tumors in spinal cord are rare compared to brain (1 spine: 4 brain)
- Majority of spinal tumors are metastatic

Etiology of SCI Rehabilitation Admissions

Non-traumatic SCD vs. Traumatic SCI

Non-traumatic SCD-39%
Traumatic SCI-61%
Spinal Cord Disease Symptoms

- Pain
  - Biologic
  - Mechanical Instability
  - Radiculopathy

- Neurological Deficits
  - Loss of Sensation
  - Paresis/Loss of Motor Function
  - Ataxia
  - Loss of Bowel and Bladder

- Clinical Signs
  - Palpation Tenderness
  - Hyperreflexia, Clonus, +Babinski

Spine Tumors

<table>
<thead>
<tr>
<th>Location</th>
<th>Intramedullary</th>
<th>Intradural/Leptomeningeal</th>
<th>Extradural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Spine Tumors

- Intramedullary: Location within the substance of the spinal cord (intradural); frequently occurs in cervical region
- Intradural/Leptomeningeal: Inside the dura around spinal cord; involves leptomeninges, CSF, and nerve roots
- Extradural: Outside of the dura (epidural space) within the osseous vertebra; can encroach on the spinal cord

Incidence:
- 75% of all spinal tumors
- 30% of all spinal tumors
- 65% of all spine tumors

Symptoms:
- Ataxia, increased muscle tone, clonus, spasticity, hyperreflexia, bowel and bladder dysfunction
- Back pain, burning pain that irradiates into the arm, trunk or leg, dysesthesias or paresis, hypoesthesia as it pushes on nerve root

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Intramedullary Disease

Leptomeningeal Disease

Extradural Disease
**Metastatic Spine Tumors**

- 30-70% of patients with skeletal mets will have vertebral involvement. 
- Systemic treatments have improved survival leading to an increased number of metastases.
- **Breast** (women), **lung** (men), prostate, and thyroid and kidney most common origins.
- Paravertebral involvement and pathological fracture cause pain.
- Frequency of location of resected metastatic tumors from highest to lowest are thoracic, lumbar, cervical and sacral.

**Medical Intervention**

**Goals**
- Alleviate pain
- Local tumor control
- Mechanical stability
- Decompress spinal cord
- Improve neurological function
- Improve quality of life

**Treatments**
- Local therapies:
  - Radiation and surgery
- Systemic therapies:
  - Chemotherapy
  - Medications

**Medical Intervention**

- NOMS framework:
  - Neurologic
    - Myelopathy
    - Functional radiculopathy
    - Degree of epidural spinal cord compression
  - Oncologic
    - Tumor histology
    - Radiation or chemosensitivity
  - Mechanical instability
  - Systemic disease and medical co-morbidity

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Radiation

- **External Beam RT**
  - Conventional EBRT (Radiosensitive)
  - Stereotactic radiosurgery (Radioresistant)
    - Image-guided intensity modulated
- **Internal RT**
  - High-dose rate brachytherapy
- **Radiation Considerations**
  - Wound healing
  - Radiation necrosis

Surgery

Surgical procedures

- Percutaneous cement augmentation
  - Kyphoplasty
  - Vertebroplasty
- Posterolateral decompression (laminectomy)
- Posterior segmental fixation
Surgery

Surgical Considerations
- CSF leak
- Wound dehiscence
- Bracing
- Spine precautions

Chemotherapy

- Systemic therapy used to slow the growth of metastatic spine tumors and reduce risk of vertebral fractures
- Treats metastatic disease typically arising from lymphoma, myeloma, breast and prostate CA

Medications

- Narcotics/Pain medications (Percocet)
- Corticosteroids (Decadron, Dexamethasone)
- NSAIDS, anti-inflammatory (Toradol, Naproxen, Celebrex, Voltaren, Mobic)
- Muscle relaxors (Baclofen, Valium)
- Neurogenic pain meds (Lyrica, Neurontin)
Rehab Implications for Patients with CNS Tumors

• General oncology considerations
  – Pain, fatigue, DVT/PE, bony metastasis, lab values
• Precautions
  – Seizure, spinal cord compression fracture, fall, safety
• Post-surgical considerations
  – Wound dehiscence, CSF leak, crani, spine precautions
Craniotomy Precautions
• HOB at 30 degrees
• Avoid bending forward
• Avoid strenuous activities
• No isometric exercises
• Avoid Valsalva maneuver
• No patient helper / trapeze
• Monitor for activities that increase pain, headache

Spine Precautions
• No bending, lifting, twisting (BLT)
• 5 lb lifting limit
• No bilateral horizontal adduction
• No resistance for MMT or ther-ex
• Range of motion restrictions
• No trapeze
• Log roll
• Monitor for activities that increase pain, headache or appearance of clear fluid

Rehab Implications for Patients with CNS Tumors
• Neurological impairments
  – Cognition, speech, vision, strength, spasticity, coordination, sensation, neglect, bowel/bladder
• Functional impairments
  – Ambulation / mobility, balance, ADL performance

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Evaluation Process in Acute Care

• Reasons for OT/PT referral:
  – Symptom presentation / decline in function
  – Post-operative patients
  – Evaluation for discharge recommendations and DME needs

Goal Setting for Patients with CNS Tumors

• Considerations:
  – Functional limitations / deficits
  – Medical intervention / treatment options
  – Progression across the cancer continuum
  – Patient centered goals
  – Family / caregiver support
  – Quality of Life
Physical Therapy for Patients with CNS Tumors

- Gait / stair training
- Neuromuscular Re-education (NDT, PNF, Neuro-IFRAH ®)
- Vestibular rehab
- Transfer training
- Therapeutic exercises

- DME training
- Family education / training
- Pulmonary hygiene
- Positioning
- Orthotic training
- Education of crani / spine precautions

PT Goal Setting in Acute Care

- Patients with brain tumors
  - Goal 1: Patient will ambulate at least 250 ft wearing a R AFO with RW and min assist x 1 to ambulate in home safely.
  - Goal 2: Patient will demonstrate good dynamic standing balance to ambulate on level and uneven surfaces safely.

- Patients with spine tumors
  - Goal 1: Patient will perform all bed mobility maintaining spine precautions with modified independence to prep for bed mobility safely.
  - Goal 2: Patient will demonstrate minimal assist with sliding board transfer between bed and wheelchair with caregiver to decrease risk for skin breakdown.
Occupational Therapy for Patients with CNS Tumors

- Neuromuscular Re-education (NDT, PNF, Neuro-IFRAH ®)
- Transfer training
- Therapeutic exercise
- Bowel / bladder training
- AE/DME training
- Energy conservation
- Family education / training
- Cognition
- ADL training
- Positioning
- Splint fabrication
- Education of crani / spine precautions
- Psychosocial support

OT Goal Setting in Acute Care

Patients with brain tumors:

- **Goal 1:** Pt will be educated in memory compensation strategies to complete multi-step kitchen task with Mod I and min VC to increase ADL performance.
- **Goal 2:** Pt will don shirt with Min A demo modified single-armed dressing technique to increase participation in ADLs.

Patients with spine tumors:

- **Goal 1:** Pt will perform all surface transfers with Mod I and AD prn while maintaining spine precautions to increase safety with OOB ADLs.
- **Goal 2:** Pt will complete LE dressing with Mod I using AE prn to maintain spine precautions and increase indep with ADLs.
Discharge Planning

- Consider functional status, prognosis, rehab potential, family/caregiver support, home environment, patient’s goals
- Home discharge:
  - Determine DME needs
  - Level of assistance needed
  - Therapy needs (home, outpatient)
- Inpatient discharge settings:
  - Rehab hospital (SAR, acute)
  - Nursing home (SNF)
- Palliative care (hospice)

Evidence Based Practice

- Use of vestibular adaptation exercises after acoustic neuroma resection results in:
  - Improved postural stability both in stance and during ambulation
  - Decreased perception of disequilibrium during early stage of recovery

Evidence Based Practice

- Support for inpatient acute rehabilitation for patients with brain tumors:
  - Patients with brain tumors have functional gains comparable to those of patients with stroke in acute rehab setting
  - Patients with brain tumors had a shorter length of stay than stroke patients
  - Both groups had high rates of discharge to the community
Evidence Based Practice

- Support for inpatient acute rehabilitation for patients with spine tumors:
  - 84% of patients with neoplastic spinal cord compression (SCC) were discharged home from rehab; 75% of those patients maintained their mobility, gait and transfer abilities for ≥3 months.
  - Patients with metastatic tumor related SCI demonstrated improved FIM scores (62 to 84) after stay at inpatient rehab SCI unit.
  - Patients with SCC due to cancer have similar functional outcomes as patients with traumatic SCI in the rehab setting.
  - Patients with neoplastic SCC have significantly shorter length of stay than traumatic SCI.

Conclusion

- CNS tumors are statistically very rare, but have profound effects on a patient’s function and QOL.
- Physical and occupational therapists must consider and educate patients on precautions and activities that may lead to post-treatment complications.
- It is important to consider a patient’s stage of disease and prognosis when setting goals.
- Physical and occupational therapists play a vital role in restoring function and QOL in the oncology neurology/neurosurgical patient.

References

References


References


Additional References

Additional References