Physical Challenges and Adaptations

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Objectives

• Define Physiatric Role in Patient Care

• Increase Awareness of Common impairments seen in Brain Tumor Survivors
  • Hemiplegia
  • Impaired coordination
  • Fatigue
  • Cognitive Dysfunction, Aphasia

• Review interventions that can be implemented to address the Impairments
  • Therapy services
  • Equipment, DME, Adaptive Aids
  • Technology services
  • Exercise
What is a physiatrist?

- A physiatrist is a Physician specialist in Physical Medicine and Rehabilitation (PM&R), responsible for patient functional health.

- PM&R is a medical specialty emphasizing the prevention, diagnosis, treatment, and restoration of functional loss produced by medical illness causing temporary or permanent functional impairment.

- Rehabilitation TEAM addresses the function of the whole patient, as compared with a focus on an organ system or systems.
Conditions treated…

- Amputation
- Spinal cord injury
- Traumatic brain injury
- Stroke
- Musculoskeletal injuries
- Pain syndromes
- Cardiac disorders
- Neurologic disorders

Among many others… including Benign and Malignant Brain Tumors
What is Cancer or Brain Tumor Rehabilitation?

• Any evaluation/intervention assisting in restoration of maximum function and ABILITY…

• in ANY patient with cancer/brain tumor…

• at ANY point in the disease continuum
Unique Survivorship Issues/Experiences

• Disease-specific
  • Cancer/Tumor type
  • Organ involvement (local/remote)

• Treatment-specific
  • Surgery
  • Chemotherapy, Hormonal therapy
  • Radiation

• Individual-specific
  • PRE-CANCER MEDICAL/FUNCTIONAL STATUS
  • PRE-DIAGNOSIS PSYCH/SOCIAL STATUS
Epidemiology

• Over 700,000 Brain tumor survivors in the USA (primary malignant and non-malignant brain and CNS tumors)

• Almost 80,000 people will be diagnosed with a primary brain tumor body this year

• Average age at diagnosis for all primary brain tumors is 60 years

• 2\textsuperscript{nd} most common cancer in children 0-14 years old and leading cause of death

• 3\textsuperscript{rd} most common cancer in ages 15-39 and 3\textsuperscript{rd} most common cause of death

https://www.abta.org/about-brain-tumors/brain-tumor-faqs/
Epidemiology

- Overall incidence of brain tumors remains small, can be a source of significant functional impairment due to neurologic sequelae
  - Potential for many of these patients to require rehabilitation services
Impairments

- In 2001, Mukand et al. (Am J Phys Med) retrospective reviewed 51 adult patients with brain tumor diagnosis
  - 31.3% Glioblastoma, 25.5% Meningioma, and 25.5% Metastatic

- Most common deficits:
  - Impaired cognition – 80%
  - Weakness - 78%
  - Visual-perceptual deficit – 53%
  - Sensory loss – 38%
  - Bowel and bladder dysfunction - 37%

- 74.5% had 3+ concurrent neurologic deficits (39.2% 5+ deficits)
Impairments

• In 2012, Kim et al (Supp Care Cancer) evaluated fatigue using in 25 brain tumors patients post-resection admitted to inpatient rehabilitation unit
  • Used Brief Fatigue Inventory (BFI) and Piper Fatigue Scale (PFS)

• 84% of patients reported fatigue over previous week
  • No significant difference between benign and malignant tumors

• No exacerbation or improvement in either fatigue scale after 4 week course of inpatient rehabilitation

• Insomnia was independent significant predictor of fatigue
Impairments

• In 2013, Zucchella et al (J NeuroOncology) performed a prospective cross-sectional study of 147 brain tumor outpatients in Italy evaluating for cognitive impairments

• 54.4% demonstrated cognitive impairment
  • 46.25% of this group had multi-domain impairments

• Deficits included language, memory, attention, executive functioning, and processing speed

• Cognitive deficits were significantly higher in older patients, those who had received chemotherapy, and those with Left hemisphere lesions
Impairments

- Hemiplegia
- Generalized Weakness
- Visual impairments
- Vestibular Dysfunction
- Impaired coordination
- Cognitive Dysfunction
- Aphasia
- Fatigue
## Identified Functional Issues

- Pain
- Weakness/Deconditioning
- Mobility Loss
- ADL’s
- Cognition
- Communication
- Swallowing/Nutrition
- Bowel/Bladder/Sexual dysfunction
- Skin integrity/breakdown
- Social Support/Depression
- Vocational/Economic concerns
This is Rehabilitation at its BEST

- Oncology Team (Medical, Surgical, Radiation)
- Rehabilitation Physician
- Physical Therapist
- Psychologist
- Pharmacist
- Social Worker
- Exer. Physiologist
- Chaplain
- Dietitian
- Occupational Therapist
- Speech Language Pathologist
- Rehabilitation Nurse
- Primary Care Team
Physical Therapist

- Work on exercise, mobilization and physical modalities to improve function.
- LE>UE focus, but treat whole body
- Training 5-6 years, DPT
Occupational Therapy

• Work on ADLs, IADLs, coordination

• Hand therapy

• Adaptive equipment

• Training 4-5 years (Master’s level)
Speech Language Pathology

• Communication
• Cognition
• Swallowing
• Training of Masters or Doctoral
Recreational Therapy, Vocational Counseling

Recreational therapy
• Using leisure skills to promote functional gains, educating patients about recreational options

Vocation counseling
• Advise Re: employment options/adaptations
Prosthetist/Orthotist

• Prosthetics—artificial limbs

• Orthotics—braces

• Usually trained in both
Tools

• Assistive Devices

• Durable Medical Equipment

• Adaptive Aids
Ambulatory Aids
Wheelchairs
Adaptive Aids
Orthotics
Orthotics
Technology Resources
Exercise

- Known to benefit multiple aspects in all individuals
  - Cardiovascular
  - Pulmonary
  - Endocrine
  - Neurologic
  - Well-Being/Psychologic
  - Quality of Life

- What does this mean to the brain tumor patient?
Exercise Molecular Effects

• Has been shown to **alter specific pathways of tumor initiation/carcinogenesis**.

• May exert a cancer preventive effect by dampening the processes involved in the promotion and progression of malignancy
  • Increased efficiency to handle reactive oxygen species (ROS)
  • Enhancing efficiency of cellular apoptosis
  • Differentiating and modulating pro-inflammatory pathways that enhance carcinogenesis

• Ability to stimulate innate immune responses and control angiogenesis
Cardiopulmonary Fitness

- Measured by peak oxygen consumption
  - \( VO_{2\text{peak}} = \text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1} \), 3.5 \( \text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1} = 1 \) Metabolic Equivalent/MET

- Known **key predictor for mortality** in all populations

- Previous research \( \rightarrow 12\% \) improvement in survival for men and a reduction of death by 17\% in women for every 1 MET increase in aerobic capacity \( ^1,^2 \)

- Breast cancer population \( \rightarrow VO_{2\text{peak}} \) is 21\% lower than age-matched healthy sedentary women.\(^3 \)

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Deconditioning

• Cumulative Multifactorial Phenomenon

• Results in Functional decline due to changes in multiple body systems
Deconditioning

• Lose 5-10% Muscle Mass per week
• Complete Immobility: Lose 1-3% of strength/day (1 week: Lose as much as 20-30%)
• After 3 weeks of bed rest, Resting HR increase to 10-12/min
• One contraction a day at 50% of maximal strength is enough to prevent this decrease
• Sensory Deprivation /Social Isolation/Depression
• Decreased Pain Tolerance
Efficacy of Exercise

- Controlled clinical trial with crossover of exercise training (vs. no training) in a volunteer sample of 28 children treated with cranial radiation for brain tumors (mean age = 11.5 yrs.; mean time since diagnosis = 5.7 yrs)
  - Evaluated the relationship between changes in cortical thickness after exercise with multiple behavioral outcomes, as well as the relation of these measures at baseline
- Exercise was associated with increases in cortical thickness within the right pre and postcentral gyri
  - Other notable areas of increased thickness related to training were present in the left pre and postcentral gyri, left temporal pole, left superior temporal gyrus, and left parahippocampal gyrus
- Compared to healthy children, participants displayed multiple areas with a significantly thinner cortex prior to training and fewer differences following training, indicating amelioration of anatomical deficits
- Found specific patterns of relations between cortical thickness and various behavioral outcomes both after training and at baseline
- Argue that exercise training should be incorporated into the development of neuro-rehabilitative program for this population and other brain injury populations

Efficacy of Exercise

- Prospectively tested whether exercise is associated with lower brain cancer mortality in 111,266 runners and 42,136 walkers from the National Runners’ and Walkers’ Health Studies
  - Analyses of mortality versus metabolic equivalent hours per day of exercise (MET-hours per day)

- National Death Index identified 110 brain cancer deaths during an 11.7-yr average follow-up
  - Runners and walkers were combined because the brain cancer risk reduction did not differ significantly between MET-hours per day run and MET-hours per day walked (P = 0.66)

- When adjusted for sex, age, race, education, and cohort effects, the risk for brain cancer mortality was 43.2% lower for those who exercised 1.8 to 3.5 MET-hr/day (P = 0.04) and 39.8% lower for those who exercised >3.6 MET-hr/day (P = 0.05) compared with <1.8 MET-hr/day at baseline

- Pooling the runners and walkers who expended >1.8 MET-hr/day showed a 42.5% lower risk of brain cancer mortality for the entire sample (P = 0.02) and 40.0% lower risk when three deaths that occurred within 1 yr of the baseline survey were excluded (P = 0.04)

Efficacy of Exercise

• 243 adult patients with recurrent WHO Grade 3 or 4 malignant glioma with KPS $\geq 70$

  • Self-Administered Questionnaire assessing Exercise behavior, 6 Minute Walk Test (6MWT)

  • Median follow-up 27.43 months

Efficacy of Exercise

• No Significance in Survival between categories of 6MWT

Efficacy of Exercise

• >9 MET-hours per week associated with median survival of 21.84 months
  • <9 MET-hours per week associated with median survival of 13.03 months

  • Functional Capacity NOT significant

  • Exercise Behavior Significant

Exercise Compliance

• 106 brain tumor survivors completed a questionnaire on self-reported exercise behavior
  • 75% had grade III or IV disease (predominantly anaplastic astrocytoma and GBM)

• 47% perceived themselves as able to exercise during treatment
  • 84% after treatment

• 45% wanted information about exercise during treatment
  • 70% after treatment

• Engage patients, families, friends, and medical personnel to take further interest and active roles in physical activity, exercise

• Determine consistent ways to measure the effect of activity on the brain tumor, treatment effects, and functions
THANK YOU!!!!!

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