Cancer and Cognitive Functioning

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Risk Factors for Cognitive Dysfunction in Cancer

- Location of cancer
  - Brain
  - Organ with effects on brain functioning
  - All others (e.g., breast)?

- Treatments
  - Surgery
  - Radiation Therapy
  - Medication
Medications in Cancer – Type of Agents

- Three general types
  - Chemotherapy – target cancer cells
  - Biological response modifiers (immunotherapies)
  - Hormone Tx
    - Common in breast and prostate cancer
- Not highly specific – can affect healthy tissues
Treatment Outcome in Cancer

- Focus on
  - Survival time
  - Time to disease progress
  - Remission
  - Cure

- Side effects – treatment toxicities
Cancer Treatment Side Effects

- Historically focused largely on physiological symptoms, like:
  - Nausea
  - Appetite loss
  - Fatigue
  - Vomiting
  - Decreased blood cell counts - anemia
  - Hair loss
  - Pain

- More recent focus on quality of life
  - Satisfaction
  - Cognitive functioning -
    - “Cancer treatment-related cognitive impairment”
“Chemobrain”

- Does it exist?
- If yes, what’s its etiology?
- What kinds of cognitive problems arise?
- How long does it last?
- What to do about it!
“Chemobrain”
Hurricane Voices Study

- Online survey - *Hurricane Voices Breast Cancer Foundation 2007*
- 471 respondents (any type of cancer, but majority with breast cancer)
- 98% reported changes in cognitive abilities during or after cancer treatment
  - Attention, memory, word finding, mental processing speed, planning/organization
- Of survivors, 5 or more years after completion of chemotherapy
  - 92% reported persistent difficulties with cognitive functioning
What Does the Research Say?

- Across other studies, self-reported cognitive difficulties in persons receiving chemotherapies have varied greatly: but up to 90%

- Is it all just chemotherapy?

- Yes and no…….

- Its typically **multifactorial!**
  - Several factors can influence a persons cognitive functioning
  - **Biopsychosocial model**
The Biopsychosocial Model

- Biological Factors
- Psychological Factors
- Social Factors
- Cognitive Functioning
Predicting Cognitive Functioning Problems: *It’s Not that Easy!*
Cancer-related cognitive dysfunction

- Cognitive declines may be present:
  - At time of cancer diagnosis
  - Before start of chemotherapy
- Examples – cognitive testing before chemotherapy
  - Women with breast cancer: 11 to 35% had cognitive dysfunction
  - Pts with small cell lung cancer: 70-80% deficits in memory functioning (Meyers et al, 1995)
  - Acute myelogenous leukemia (AML): 41-44% deficits in memory functioning (Myers et al., 2005)

Possible Reasons:
- Inflammation processes
- Autoimmune mechanisms
- Other medications
  - E.g., pain medications
- Emotional functioning
- Fatigue
Best studies are those that:

- Compare pre-chemotherapy and post-chemotherapy findings: longitudinal-prospective studies
- Use objective measures of cognitive functioning – neuropsychological tests
- Use good comparison groups
The Complexity of It All – Chemotherapy Effects

- **Wefel et al (2004)** – one of the first prospective studies on chemotherapy
  - Early stage breast cancer survivors
  - Measurement: pre; 3-weeks post; 1-year post
  - Findings:
    - Pre-chemo (baseline):
      - 33% showed impairment
    - 3-weeks post treatment:
      - 61% showed evidence of decline in one or more cognitive areas
    - 1-year post:
      - 50% with initial decline improved
      - Rest remained stable – i.e., ~ 30% showed persistent declines

- Across other forms of non-brain cancer results for relationship between chemotherapy and cognitive functioning have varied
  - For example:
    - Small cell lung cancer study (Whitney et al; 2008)
      - 62% showed some form of cognitive decline 1 month after chemotherapy
      - At 7 months post chemotherapy nearly total resolution for most
    - Review of advance prostate cancer studies – hormone therapy (Nelson et al; 2008)
      - 9 studies from 2002 to 2006: nearly all with small sample sizes
      - Compared pre-treatment to 6 to 12 months post-treatment
      - Conclusions:
        - 47% to 69% of men showed “subtle but significant declines” in one or two domains (e.g., memory), but not across all cognitive domains.

- **More recent study by Wefel et al (2010)**
  - Essentially replicated findings from 2004 study
  - Also – nearly a third showed *new* decline at the 1-year measurement point
  - Vast majority showed only one cognitive area affected
Chemotherapy Effects: Typical Cognitive Problems

- Most frequent areas of demonstrated decline
  - Learning and memory
  - Speed of mental processing / attention
  - Executive functioning
    - Cognitive flexibility
    - Problem solving
    - Verbal fluency (response initiation and organization)

- Often the degree of decline is mild
  - But may not be proportional to effect on functional status – e.g., home or work setting demands
Chemotherapy Effects: Direct Mechanisms

- Neural mechanisms underlying cognitive changes – poorly understood

- Chemotherapeutic agents crossing the blood brain barrier?
  - Possible individual differences

- Oxidative stress
  - Reaction to oxygen creates free radicals – lead to cell damage
  - Normal metabolism creates oxidative stress
  - Chemotherapy can induce further oxidative stress

- Metabolic changes causing inflammatory reactions that injure nerve cells

- Microvascular injury in the brain
  - White matter may be especially vulnerable

- Anemia – decrease oxygen to the brain
  - Occurs at a high rate in persons treated with chemotherapy

- Effects on nerve cell generation and repair – e.g., suppression of neurogenesis in hippocampus
Chemotherapy Effects: Indirect Mechanisms

- Effects on other organs that can affect brain functioning
  - E.g., liver or kidneys
- Psychiatric symptoms
  - E.g., increases in depression shown with interferon alpha for treatment of leukemia
- **Fatigue**
  - Increased mental effort to sustain sufficient cognitive performance?
  - Price to pay…..
What Helps?
Improving Cognitive Functioning

- What to do first
- Mindset - Lifestyle Changes
- Self-Help Strategies
- Formal Cognitive Rehabilitation / Treatment
First Step – Address Reversible Conditions

- Tell your doctor!
- There may be reversible causes – need to sort out the factors
- For example:
  - Medication changes to less cognitive interfering ones
  - Medication for sleep / sleep study?
  - Medication to improve energy level
  - Examination of blood counts – e.g., anemia, vitamin deficiencies
  - Treatment for pain
    - Medication /Physical Therapy / Cognitive-Behavioral Strategies
  - Treatment for depression / anxiety
What helps in day-to-day life?

- Mind set
  - Be mindful of difficulties
  - But try to “normalize” them – avoid being hard on yourself!
  - It's going to take more effort!
  - Self-efficacy – I can make a difference (cognitive re-structure)
Lifestyle Changes

- **Get organized!**
  - Establish consistent daily routines
    - Regular wake and sleep time
    - Meal time
    - Routine activities
  - Have a central (or “hub”) place for essential, routinely used items
    - Keys, wallet, purse, mobile/smart phone
More Lifestyle Changes!

- **Time management**
  - Plan daily or weekly schedule ahead of time – **write out a check list**
  - Prioritize activities – what’s essential to get done
  - Estimate how long a given activity will take – be sure to allow sufficient time!
  - Adjust schedule in day if unexpected problems arise – look at activity priorities
  - Check over list at the end of day – adjust next day schedule
More Lifestyle Changes!!

- **Establish more positive habits**
  - Exercise – get okay from medical providers
    - Positive effects on mood and cognition
  - Good nutrition
  - Watch alcohol consumption / recreational drug use
  - Manage sleep / fatigue
Even More Lifestyle Changes - Dealing with Fatigue

- Cancer-related fatigue
  - One the most commonly reported and stressful symptoms in persons with cancer
    - Prevalence rates vary – 50% to 99% (higher with chemotherapy)
    - May last for years posttreatment

- Trying to function at an acceptable level --
  - But at a greater cost
  - Mental – physical fatigue
Combating Fatigue

- Check with your physician
  - Any co-occurring medical problems, e.g., anemia, sleep apnea, pain
  - Medications
    - Increase energy/alertness
    - Improve sleep (watch for possible cognitive side effects)
  - Pain

- Nonpharmacological strategies
  - Exercise – if medically cleared
    - E.g., take short walks / light exercise
  - Manage sleep
    - To nap or not to nap? – that is the question!
    - Sleep hygiene strategies
  - Pace yourself during the day
    - Take breaks when you can, even if not yet overly fatigued
    - Be flexible – task schedule, work schedule
  - Do important tasks when you have the most energy
  - Delegate – i.e., get help for tiring tasks
  - Nutrition

Sleep hygiene tips
http://healthysleep.med.harvard.edu/healthy/getting/overcoming/tips
Strategies for Improving Cognitive Functioning
Improving Cognitive Functioning: Restoration Vs. Compensation

- **Restoration** – make improvements in our natural cognitive abilities
  - *Brain / mental exercising*
  - Medication

- **Compensation**
  - Focus is on lessening the interference of cognitive problems in performing daily tasks
  - Develop internal and external strategies / tools to make up for cognitive functioning problems
  - Goal is to improve ability to perform given tasks, e.g.,
    - Methods to better sustain attentional focus
    - Methods for better recall of important information
      - Conversations / events
      - Appointments / tasks to do
    - Methods to improve organization and planning, problem-solving
Restoration Strategies

- Guided, repetitive practice on a set of specific tasks designed to improve cognitive abilities: e.g., attention, memory, executive functioning
- Can be computer-based or delivered by a therapist (e.g., Speech Therapist)
  - Computer-based
    - Lumosity
    - CogniFit Personal Coach
- Requires repetition – e.g., maybe up to 50-60 sessions; 15-90 minutes per session
- Study (2013) by Kesler et al. at Stanford Univ. on women with breast cancer + chemotherapy
  - Lumosity
  - Target – executive functions (e.g., cognitive flexibility, processing speed, verbal fluency)
  - Pre-post testing showed significant improvements on several tests
  - Most participants felt improvement in their abilities
Restoration Strategies: Current Status

- Verdict remains out
- Promising for some individuals
  - E.g., may raise confidence in abilities
- Often improvement occurs on pre-post treatment tests of cognitive abilities that have been targeted in treatment
- Questions remains about generalizability
  - Does functional status in daily life improve?
  - Are beneficial effects long-term?
- Monetary costs
- Not many comparison studies have been done with other cognitive treatment strategies (e.g., compensation) or life-change strategies
Compensatory Strategies – What You Can Do on Your Own!

- Attention
- Memory
- Emotional Functioning
Managing Attention Problems

- Be more mindful on what needs to be done in the moment
  - E.g., when leaving the house
  - Much easier said than done – takes effort!!

- Keep distractions to a minimum when doing complex tasks -- e.g.,
  - Quiet please!
  - Remove clutter from desk
  - Unplug the phone
  - Perform the task away from computer (if it's not involved)

- Complete only one task at a time - avoid multitasking
  - Give yourself enough time to complete each task

- Divide complex tasks into small steps

- Take planned rest breaks
Compensating for Memory Problems

- Memory functioning -- stages
  - Acquisition
  - Storage
  - Retrieval
- Breakdown can occur at any of the stages
- Strategies can be applied for each stage
Compensating for Memory Problems: Strategies by Stages

- **Acquisition**
  - Focus attention – minimize distractions
  - Make sure you understand info
  - Ask for info to be given slower or repeated

- **Storage / Retrieval**
  - Mentally rehearse information
  - Organize information
    - Any underlying themes
    - Link to something meaningful – old information
    - Use mnemonic strategies
      - Acronyms
      - Easy to remember phrases (1st letter represents a word on the target list)

- ***** Written / Computerized Compensatory Strategies**
  - Memory Book
Compensating for Memory Problems – The Memory Book!

- Memory book = daily planner = daytimer
- Use one central memory book
  - *Avoid the sticky approach*
  - Smart phone versus written daytimer
    - Smart phone → task initiation alarms!

- What to put in
  - Daily schedule – e.g., appts., to-do-list; alarms
    - Check off space
  - Summary of important conversations
    - E.g., Family members, new medical info, care providers, co-workers

- *Remember to remember* to use your memory device!

- Other strategies:
  - Pill box for medications
  - Memory board in one location – e.g., kitchen
What Helps – Improving Emotional Functioning

- Stress management
  - Self-help books on relaxation
  - Join a meditation / yoga class
  - Identify and prioritize stressors
    - Put the immediate fires out!
    - Problem solve – accept

- Pleasurable activities

- Exercise
  - Join an exercise class at a fitness club

- Treatment if necessary
  - Psychotherapy / Medication
What Else To Do? Neuropsychological Evaluation

- Seek an evaluation – if cognitive problems persist and especially if:
  - Day-to-day functional status is being significantly affected (e.g., work performance)
  - Difficulties seem to be worsening over time
    - Of course - consult with your physician!

- Provides objective measurement of cognitive capacities
  - Attention / Mental Processing Speed / Memory / Communication / Visuospatial Functioning / Executive Functions (Problem Solving, Reasoning, Thinking Flexibility)

- Evaluates emotional / personality / behavioral factors

- Neuropsychological evaluations help to
  - Determine the type and degree of problems
  - Disentangle factors affecting cognitive functioning
  - Indicate your ability to engage in certain activities, like work
  - Devise a road map for treatment
Formal Neuro-Rehabilitation Treatment

- Treatment program developed specifically for the given individual
- Can include some or all of the following:
  - Cognitive Rehabilitation
    - Often by Speech Therapy
    - Typically focuses on compensatory strategies but could combine restorative types of activities
  - Physical Therapy
    - E.g., for pain
  - Occupational Therapy
    - E.g., improvement in functional tasks at home
  - Psychotherapy
  - Vocational Rehabilitation
  - Rehabilitation Medicine Physician Consultation
Thanks!