ADULT BONE MARROW TRANSPLANTATION: IMPLICATIONS FOR THE PHYSICAL THERAPIST

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Certified Lymphedema Therapist

DISCLAIMER-ISH

- This presentation covers some very basic rehab implications as they pertain to treating patients about to receive, or after receiving a bone marrow transplant. It is far from all inclusive as it pertains to diagnosis, assessment, and treatment interventions.
- While some of these processes are similar for adolescent and young adult bone marrow transplant, this presentation covers those who are classified as adults during their bone marrow transplant journey.
- I'm not a pharmacist, medical doctor, physician’s assistant or any other medical professional. Please consider that regarding some of the material presented here.

STEM CELL TRANSPLANT BASICS

LETS BREAK IT DOWN (WAY DOWN)
LETS BREAK IT DOWN (WAY DOWN)

5

TYPES OF TRANSPLANTS

- Autologous Stem Cell Transplant: The cells for transplant come from the patient themselves.
- Allogeneic Stem Cell Transplant: The cells for transplant come from a donor.
  - Matched related/unrelated donor (MRD, MUD)
  - Haploidentical match
  - Cord Blood

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TYPES OF CANCERS TREATED WITH BONE MARROW TRANSPLANTS

- Acute Myeloid Leukemia (AML)
  - Percent of all cancer cases: 1.1%
  - 1-year survival rate: 47.4%
  - 5-year survival rate: 39.3%
  - Only 4% of cases are localized

- Multiple Myeloma (MM)
  - Percent of all cancer cases: 1.8%
  - 1-year survival rate: 79.4%
  - 5-year survival rate: 55.6%

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STATISTICS (AT A GLANCE)

8
9/14/21

INDUCTION THERAPY
For patients with newly diagnosed AML

NEWLY DIAGNOSED AML

- Immediate admission if suspected AML – considered a life-threatening emergency
- Signs/symptoms:
  - Fatigue
  - Anemia
  - Leukocytosis
  - Easy bruising
  - Abnormal bleeding (nose, mouth, etc.)
- Named induction to “induce” remission
- Must be in remission to continue to SCT
- Induction timeline:
  - Daunorubicin: Days 1-3
  - Cytarabine: Days 1-7 (24 hour infusion)

SIDE EFFECTS OF INDUCTION THERAPY
- Severe myelosuppression
- Neurotoxicity
- Thrombocytopenia
- Acute vs chronic myocardial toxicity
- Fatigue
- GI distress
- Many more!

CARDIOTOXICITY FROM ANTHRACYCLINES
- Known to cause cardiotoxicity
- Heart failure can occur if high cumulative doses
- ACE inhibitors and beta-blockers used for treatment
- Therapy implications:
  - Elevated resting heart rate
  - Increased heart rate with low-level activities
  - Increased fatigue
  - Underlying or induced arrhythmias
Nadir occurs between days 10-15.

Bone marrow biopsy performed at 14
days to determine if leukemia is in
remission.

If not, a new cycle (re-induction) is started with a
new agent and the 30-day clock starts over

Admitted until count recovery.

Hospitalization is usually no less than four
weeks but may be longer.

**STEM CELL TRANSPLANTATION**

**PROCESS**

**Autologous vs Allogeneic Transplantation**

**AUTO VS ALLO ADMISSION**

**AUTOLOGOUS STEM CELL TRANSPLANT**

- Will often receive Melphalan (alkylating
  agent) prior to SCT
- Admitted 1-3 days prior to SCT
- In the case of multiple myeloma, think
  bone metastasis
  - Up to 80% are found to have bone
    metastasis at diagnosis
  - Avoid fractures (most common are
    vertebral and proximal long bones)
ALLOGENEIC STEM CELL TRANSPLANT

- Prior therapies: Anthracycline given prior to SCT – the dreadful 7+3
- Prior to SCT will be admitted for 5-7 days for myeloablative therapy
- Longer length of stay

TOTAL BODY IRRADIATION

- Can be used in both auto and allo SCT.
- Used as a supplemental myeloablative treatment, eradicating disease, and creating space for donor cells to engraft
- Side effects include:
  - Nausea and vomiting
  - Mucositis
  - Idiopathic pulmonary fibrosis
  - Delayed renal failure (can occur within ~2 years)
  - Severe fatigue

MEDICAL COMPLICATIONS OF STEM CELL TRANSPLANTS

EARLY (WITHIN THE FIRST 100 DAYS)
- Acute Graft vs Host Disease
- Veno-occlusive disease
- Nausea and vomiting
- Upper Respiratory Infections

LATE (>100 DAYS)
- Chronic Graft vs Host Disease
- Cardiovascular complications

A NEW IMMUNE SYSTEM: SPECIAL CONSIDERATIONS

Cellular Immunity: Protects the body against intracellular pathogens. Doesn’t involve production of SPECIFIC antibodies.

Humoral Immunity: Protects the body against extracellular pathogens and their toxins. More specific immunity.
REHAB IMPLICATIONS: LAB VALUES AND BONE METASTASIS

Lean Muscle

- One day of bedrest can lead to 1-2% of lean muscle loss
- Weight loss and appetite changes are common prior to an accurate diagnosis
- Also common during active treatment
- Patients with the diagnosis of cancer are found to have greater lean muscle loss at diagnosis
- Chemotherapy treatment can lead to lean muscle loss
- Presence of sarcopenia is associated with poorer overall survival

Quick and Dirty

ADL's
- Essential and routine tasks required to care for oneself
  - Ambulating
  - Feeding
  - Dressing
  - Personal Hygiene
  - Toileting
  - Continence (ability to control bowel/bladder)

Physical Activity
- Bodily movement that requires skeletal muscle resulting in energy expenditure
  - Occupational
  - Sport
  - Conditioning
  - Household
  - Other activities

Exercise
- Subset of PA that is planned, structured, and repetitive with a final or intermediate objective

Activities of Daily Living

Vs

Physical Activity

Vs

Supervised/Therapeutic Exercise

Caspersen, 1985
ADL's  PA  Exercise

WHAT ARE THE GOALS?

While each day in the hospital may look different, we must consider:
1. What is the patient's end goal?
2. What are our goals based on the patient's goals?
   - How will we arrive at those end goals?

ABNORMAL LAB VALUES

It is up to you to make the appropriate clinical decisions on when it is appropriate to treat each patient and how to treat each patient.

BONE MET SCORING SYSTEMS

THE MIRELS SCORE: LONG BONE METASTASIS

<table>
<thead>
<tr>
<th>Score</th>
<th>Size of lesion</th>
<th>Size of fracture</th>
<th>Nature of lesion</th>
<th>Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upper limb</td>
<td>&lt; 4 cm</td>
<td>Minimal</td>
<td>Med.</td>
</tr>
<tr>
<td>2</td>
<td>Lower limb</td>
<td>&gt; 4 cm</td>
<td>Minimal</td>
<td>Med.</td>
</tr>
<tr>
<td>3</td>
<td>Upper limb</td>
<td>&gt; 4 cm</td>
<td>Moderate</td>
<td>Med.</td>
</tr>
<tr>
<td>4</td>
<td>Upper limb</td>
<td>&gt; 4 cm</td>
<td>High</td>
<td>Med.</td>
</tr>
<tr>
<td>5</td>
<td>Upper limb</td>
<td>&gt; 4 cm</td>
<td>Very High</td>
<td>Med.</td>
</tr>
</tbody>
</table>

Mirels' score  Clinical recommendation
≤ 7  Back/therapy and observation
8   Use clinical judgment
≥ 9  High risk: Enactive
BONE MET SCORING SYSTEMS

THE TANEICHI SCORING:
- Vertebral Metastasis
  - Stable
    - <50% of the vertebral body affected
    - Pedicles not affected
    - Negative posterior element involvement
  - Unstable
    - >50% of the vertebral body affected
    - Pedicles affected
    - Posterior element destruction

CONSIDERATIONS
- Consultation and further information from the medical provider
- Always assess pre, during, and post intervention
- Pain
- Neurological symptoms
- New or change in limitation of movement

Malsters, et al, 2017

STATE OF THE EVIDENCE: IS REHAB INDICATED FOR HSCT?
- An (extremely) brief review

FUNCTIONAL CAPACITY AND SURVIVORSHIP
- The 6MWD is a significant univariate predictor of clinical outcomes but DID NOT provide prognostic information beyond that of traditional prognostic markers in HSCT.
CARDIOVASCULAR TOXICITY

Efficacy and mechanisms of exercise to prevent or mitigate cardiovascular toxicity after a cancer diagnosis are limited.

- Poor cardiorespiratory fitness is associated with:
  - Higher prevalence of acute and chronic treatment-related toxicities (e.g., CVD)
  - Higher symptom burden (e.g., fatigue)
  - Increased risk of all-cause and cancer-specific mortality.

Some evidence is suggestive of the cardioprotective effect of exercise during specific anthracycline treatments.

EXERCISE, FATIGUE AND QOL

Exercise had a positive effect on LE strength, fatigue and quality of life especially if it was started PRE-TRANSPLANT.

- No effect on patients’ cardiorespiratory fitness, upper muscle strength, psychosocial, fitness and adverse events.

BALANCE AND FALLS

- Allo transplant 3 x higher fall risk than auto transplant
- Few standardized measures validated for this sub-population

There are 5 recommended measures from the EDGE Taskforce:
- Gait speed (fast vs usual)
- TUG
- 5x Sit-to-stand
- Timed Up-and-Go
- 6x Sit-to-stand

STRENGTH TRAINING

- Avoid
- 1-RM max on patients with bone metastasis
- 1-RM max and heavy lifting for those with low platelet counts
- Consider goals: strength vs hypertrophy vs endurance training
- Modifiable HEP’s: Discuss measuring training load at home
- Repetitions in reserve

Exercise for physical fitness, fatigue and quality of life of patients undergoing hematopoietic stem cell transplantation: a meta-analysis of randomized controlled trials

Yonghao Liang, Mingrui Zhao, Fanfan Wang, and Zhidai Wu

- Exercise had a positive effect on LE strength, fatigue and quality of life especially if it was started PRE-TRANSPLANT.
- No effect on patients’ cardiorespiratory fitness, upper muscle strength, psychosocial fitness and adverse events.
AEROBIC CONDITIONING
- Adjusting recommendations set forth by ACSM for the SCT population
- Rate of perceived exertion or BORG scale
- Giving patients guidelines to adapt at home

BALANCE AND FALLS
- Continuous re-assessment throughout the admission
- Address ways to improve balance safely after discharge
- Address fear of falling, and encourage mobility

THE BIG PICTURE

ALLO VS AUTO – NEED TO KNOW
- Differences in length of stay
- Corticosteroid use
- Difference in induction regimens
- Bone metastasis
LEARNING FROM PAST (CURRENT?) MISTAKES

- Underutilization of physical activity and exercise
- Demonstrating the benefits of early implementation
- Utilizing telehealth
- Prospective surveillance

QUESTIONS

REFERENCES/RESOURCES


• Rindflesch, Aaron B. PT, PhD, NCS1; Hake, Melissa P. PT, DScPT2; Meyer, Tanya3; Murphy, Ryan3; Olson, Morgan L.3; Uphoff, Kayla3; Hollman, John H. PT, PhD4. Identifying Fall Risk of Patients Receiving Hematopoietic Cell Transplant, Rehabilitation Oncology: July 2018 - Volume 36 - Issue 3 - p 167-171 doi: 10.1097/01.REO.0000000000000113


THANK YOU

Please feel free to reach out to me if you have any questions regarding this presentation, or the bone marrow transplant process. sowell1989@gmail.com