Indexing Metadata/Description

- Title/condition: Cancer in Children (Occupational Therapy)
- Synonyms: Childhood cancer (occupational therapy); tumors in children (occupational therapy); pediatric malignancies (occupational therapy); lymphoma in children (occupational therapy); leukemia in children (occupational therapy)
- Anatomical location/body part affected: Any body organ, tissue (e.g., bone, bone marrow, lymphatic tissues, brain, spinal cord, kidney, muscles, tendons, blood vessels, bone, retina)
- Area(s) of specialty: Pediatric Rehabilitation, Oncology
- Description
  - While cancer in children can occur in any body organ or tissue, the most common childhood cancers are:
    - Leukemia – malignancy of bone marrow, with growth of abnormal blast cells (lymphocytes)\(^1\)
      - Acute lymphoblastic leukemia (ALL) – affects lymphoid cells in bone marrow
      - Acute myelogenous leukemia (AML) – affects myeloid cells in bone marrow
    - Lymphoma – malignancy of the lymphatic system
      - Non-Hodgkin lymphoma (NHL) – tumor of the lymphatic tissues, with involvement of bone marrow and central nervous system\(^1\)
        - Hodgkin disease – tumor of the lymphatic tissue\(^1\)
    - Brain and spinal cord cancer – tumors in the brain or spinal cord
      - Neuroblastoma – malignancy of nerve cells, located in adrenal gland, neck, chest, or spinal cord\(^2\)
      - Wilms tumor – solid malignant tumor found in one or both kidneys
    - Soft tissue sarcoma – tumor found in the soft tissues of the body, such as muscles, tendons, synovial tissues, fat tissues, blood vessels, lymph vessels, or nerves\(^3\)
    - Bone cancer
      - Osteosarcoma – tumor of the bone, osteoblasts (which make bone)\(^4\)
      - Ewing’s tumor – tumor of the connective tissues around large bones\(^4\)
    - Retinoblastoma – malignant tumor of the retina
- ICD-9 codes
  - 204.0 lymphoid leukemia acute
    - 204.00 lymphoid leukemia acute without mention of having achieved remission
    - 204.01 lymphoid leukemia acute in remission
    - 204.02 acute lymphoid leukemia, in relapse
  - 204.1 lymphoid leukemia chronic
    - 204.10 lymphoid leukemia chronic without mention of having achieved remission
    - 204.11 lymphoid leukemia chronic in remission
    - 204.12 chronic lymphoid leukemia, in relapse
  - 204.2 lymphoid leukemia subacute
    - 204.20 lymphoid leukemia subacute without mention of having achieved remission
    - 204.21 lymphoid leukemia subacute in remission
    - 204.22 subacute lymphoid leukemia, in relapse
  - 204.8 other lymphoid leukemia
    - 204.80 other lymphoid leukemia without mention of having achieved remission
    - 204.81 other lymphoid leukemia in remission
    - 204.82 other lymphoid leukemia, in relapse
  - 204.9 unspecified lymphoid leukemia
    - 204.90 unspecified lymphoid leukemia without mention of having achieved remission
    - 204.91 unspecified lymphoid leukemia in remission
    - 204.92 unspecified lymphoid leukemia, in relapse
  - 205.0 myeloid leukemia acute
    - 205.00 myeloid leukemia acute without mention of having achieved remission
    - 205.01 myeloid leukemia acute in remission
    - 205.02 acute myeloid leukemia, in relapse
  - 205.1 myeloid leukemia chronic

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205.10 myeloid leukemia chronic without mention of having achieved remission
205.11 myeloid leukemia chronic in remission
205.12 chronic myeloid leukemia, in relapse

• 205.2 myeloid leukemia subacute
  • 205.20 myeloid leukemia subacute without mention of having achieved remission
  • 205.21 myeloid leukemia subacute in remission
  • 205.22 subacute myeloid leukemia, in relapse

• 205.3 myeloid sarcoma
  • 205.30 myeloid sarcoma without mention of having achieved remission
  • 205.31 myeloid sarcoma in remission
  • 205.32 myeloid sarcoma, in relapse

• 205.8 other myeloid leukemia
  • 205.80 other myeloid leukemia without mention of having achieved remission
  • 205.81 other myeloid leukemia in remission
  • 205.82 other myeloid leukemia, in relapse

• 205.9 unspecified myeloid leukemia
  • 205.90 unspecified myeloid leukemia without mention of having achieved remission
  • 205.91 unspecified myeloid leukemia in remission
  • 205.92 unspecified myeloid leukemia, in relapse

• 206.0 monocytic leukemia acute
  • 206.00 monocytic leukemia acute without mention of having achieved remission
  • 206.01 monocytic leukemia acute in remission
  • 206.02 acute monocytic leukemia, in relapse

• 206.1 monocytic leukemia chronic
  • 206.10 monocytic leukemia chronic without mention of having achieved remission
  • 206.11 monocytic leukemia chronic in remission
  • 206.12 chronic monocytic leukemia, in relapse

• 206.2 monocytic leukemia subacute
  • 206.20 monocytic leukemia subacute without mention of having achieved remission
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  • 206.22 subacute monocytic leukemia, in relapse

• 206.8 other monocytic leukemia
  • 206.80 other monocytic leukemia without mention of having achieved remission
  • 206.81 other monocytic leukemia in remission
  • 206.82 other monocytic leukemia, in relapse

• 206.9 unspecified monocytic leukemia
  • 206.90 unspecified monocytic leukemia without mention of having achieved remission
  • 206.91 unspecified monocytic leukemia in remission
  • 206.92 unspecified monocytic leukemia, in relapse

• 207.0 acute erythremia and erythroleukemia
  • 207.00 acute erythremia and erythroleukemia without mention of having achieved remission
  • 207.01 acute erythremia and erythroleukemia in remission
  • 207.02 acute erythremia and erythroleukemia, in relapse

• 207.1 chronic erythremia
  • 207.10 chronic erythremia without mention of having achieved remission
  • 207.11 chronic erythremia in remission
  • 207.12 chronic erythremia, in relapse

• 207.2 megakaryocytic leukemia
  • 207.20 megakaryocytic leukemia without mention of having achieved remission
  • 207.21 megakaryocytic leukemia in remission
  • 207.22 megakaryocytic leukemia, in relapse

• 207.8 other specified leukemia
  • 207.80 other specified leukemia without mention of having achieved remission
  • 207.81 other specified leukemia in remission
  • 207.82 other specified leukemia, in relapse

• 208.0 leukemia of unspecified cell type acute
  • 208.00 leukemia of unspecified cell type acute without mention of having achieved remission
  • 208.01 leukemia of unspecified cell type acute in remission
  • 208.02 acute leukemia of unspecified cell type, in relapse
• 208.1 leukemia of unspecified cell type chronic
  – 208.10 leukemia of unspecified type chronic without mention of having achieved remission
  – 208.11 leukemia of unspecified cell type chronic in remission
  – 208.12 chronic leukemia of unspecified cell type, in relapse
• 208.2 leukemia of unspecified cell type subacute without mention of having achieved remission
  – 208.20 leukemia of unspecified cell type subacute without mention of having achieved remission
  – 208.21 leukemia of unspecified cell type subacute in remission
  – 208.22 subacute leukemia of unspecified cell type, in relapse
• 208.8 other leukemia of unspecified cell type
  – 208.80 other leukemia of unspecified cell type without mention of having achieved remission
  – 208.81 other leukemia of unspecified cell type in remission
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• 208.9 unspecified leukemia
  – 208.90 unspecified leukemia without mention of having achieved remission
  – 208.91 unspecified leukemia in remission
  – 208.92 unspecified leukemia, in relapse

› ICD-10 codes
  • C81 Hodgkin’s lymphoma
  • C82 follicular lymphoma
  • C83 diffuse non-Hodgkin’s lymphoma
  • C85 other and unspecified types of non-Hodgkin's lymphoma
  • C86 other specified types of T/NK-cell lymphoma
  • C88 malignant immunoproliferative diseases and certain other B-cell lymphomas
  • C90 multiple myeloma and malignant plasma cell neoplasms
  • C91 lymphoid leukemia
  • C92 myeloid leukemia
  • C93 monocytic leukemia
  • C94 other leukemias of specified cell type
  • C95 leukemia of unspecified cell type
  • C96 other and unspecified malignant neoplasms of lymphoid, hematopoietic and related tissue

› Reimbursement
  • Reimbursement for therapy will depend on insurance contract coverage
  • No specific issues or information regarding reimbursement have been identified

› Presentation/signs and symptoms
  • Leukemia
    – Anemia, paleness, listlessness, irritability\(^{(1)}\)
    – Chronic tiredness\(^{(1)}\)
    – Recurrent infections\(^{(1)}\)
    – Bleeding episodes\(^{(1)}\)
    – Lymphadenopathy\(^{(1)}\)
    – Hepatosplenomegaly\(^{(1)}\)
    – Bone and joint pain\(^{(1)}\)
  • NHL
    – Commonly found in the lymph tissues of the intestinal tract: acute abdominal pain\(^{(1)}\)
    – Nontender lymph node enlargement\(^{(1)}\)
  • Hodgkin disease
    – Painless enlargement of lymph nodes (usually in the cervical region)\(^{(1)}\)
    – Chronic cough if trachea involved\(^{(1)}\)
    – Fever\(^{(1)}\)
    – Decreased appetite\(^{(1)}\)
    – Weight loss\(^{(1)}\)
    – Night sweats\(^{(1)}\)
  • Neuroblastoma
    – Abdominal swelling\(^{(4)}\)
    – Listlessness\(^{(4)}\)
    – High blood pressure\(^{(4)}\)
    – Decreased appetite\(^{(4)}\)
    – Weight loss\(^{(4)}\)
Persistent diarrhea
Black/blue around eyes
Fever
Sweating
Weakness in arms/legs
Anemia
Coughing, shortness of breath
Problems with voiding
Bone pain/swelling

Brain and spinal cord tumors (depends on the part of the brain or spinal cord affected)
Visual disorders
Seizures
Paralysis of a part of the body
Tremors
Hydrocephalus
Poor muscle tone, balance
Loss of bowel/bladder control
Impaired reflexes, gait
Constant/intermittent pain in neck, shoulder, chest, abdomen, pelvis, or extremities

Soft tissue sarcoma
Lump, mass found anywhere in body
No pain or swelling in and around the mass

Osteosarcoma
Pain; worse at night
Persistent unusual pain/swelling near bone

Retinoblastoma
Changes in appearance of eye
White spot on pupil
Squint
Eye misalignment
Loss of vision
Glaucoma (increase pressure in the eye)
Red/painful eye

Wilms tumor
Pain in abdomen
Blood in urine

Causes, Pathogenesis, & Risk Factors

- Causes
  - Mainly idiopathic
  - Childhood leukemia is thought to be due to chromosomal or genetic factors or exposure to ionizing radiation

- Pathogenesis
  - Pathogenesis of childhood cancers varies according to type
  - Cells within organs or tissues of the body divide more than they should, grow in abnormal patterns, or are destroyed, which leads to the growth of an abnormal mass
  - Malignant cells can replace bone marrow and infiltrate lymph to enter the bloodstream

- Risk factors
  - Infection increases risk of lymphomas, sarcomas
    - Infectious mononucleosis
    - Human immunodeficiency virus (HIV)
    - Human T-cell lymphotrophic virus (HTLV)
    - Epstein-Barr virus
  - Exposure to radiation
  - Cancer treatments such as radiation therapy and chemotherapy may increase risk for a second primary cancer
  - Beckwith-Wiedemann syndrome (genetic disorder) increases risk of Wilms tumor
  - Children with aniridia (missing iris of eye) are at increased risk for Wilms tumor
  - Risk factors for neuroblastoma
    - Maternal exposure to phenytoin for seizures
    - Neurofibromatosis
Neurofibromatosis
– Overgrowth of pancreatic cells

**Overall Contraindications/Precautions**

- Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician in regards to treatment intervention and treatment intensity
- For postoperative patients, follow postoperative precautions and protocols as directed by surgeon
- Fatigue is common in children with cancer; exercise professional judgment and caution when assessing and treating patients with cancer
- See specific Contraindications/precautions to examination and Contraindications/precautions under Assessment/Plan of Care

**Examination**

- **Contraindications/precautions to examination**
  - Respect child’s self-report of pain and fatigue, which are common side effects of cancer treatment
  - Orthostatic hypotension can be of concern in patients who have undergone bone marrow transplantation (see Clinical Review... Bone Marrow Transplantation in Children; Accession Number: 5000010877)

- **History**
  - **History of present illness/injury:** Ask when the child was diagnosed with cancer; if the cancer has spread, ask about original site
  - **Course of treatment**
    - **Medical management:** Common treatments include:
      - Chemotherapy – variety of toxic chemicals to kill cancer cells
      - Intravenous (I.V.) administration of chemotherapy – chemotherapeutic agents are administered directly into the bloodstream
      - Intrathecal administration of chemotherapy – chemotherapeutic agents are administered directly into the cerebrospinal fluid
      - Radiation therapy
        - External beam/teletherapy – radiation to tumor site in a targeted stream
        - Proton accelerators – use of imaging techniques to pinpoint tumor and target cancer cells
        - Conformal radiation – radiation of tumor from several directions
        - Brachytherapy – radioactive implants are inserted directly into a tumor
      - Transplantation – transplantation of bone marrow or stem cells after high-dose chemotherapy and radiation to facilitate growth and regeneration of new blood cells
      - Surgery – removal of solid tumors
      - Molecularly targeted drugs – (e.g., Imatinib mesylate (Gleevec), which is approved by the U.S. Food and Drug Administration (FDA) for use in chronic myelogenous leukemia (CML). It blocks abnormal enzymes on tumor cells)
    - **Medications for current illness/injury:** Determine what medications clinician has prescribed; are they being taken?
    - **Diagnostic tests completed:** A variety of diagnostic tests may be indicated depending on the location of the cancer and any complications that arise during treatment. Some of the most common are the following:
      - Laboratory tests, including but not limited to, CBC with differential WBC, platelet and reticulocyte, liver function tests, lactate dehydrogenase, uric acid and electrolyte level, 8-hour creatinine clearance
      - Peripheral smear – microscopic examination of a peripheral blood smear to evaluate blood disorders
      - Bone marrow examination
      - Lumbar puncture
      - Medical imaging
        - X-rays/radiographs
        - Computed tomography (CT) scan
        - Magnetic resonance imaging (MRI)
        - Positron emission tomography scan (PET)
        - Gallium scan
        - Bone scan
        - Ultrasound
      - Biopsy – removal of tissue to be examined under a microscope
    - **Home remedies/alternative therapies:** Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture, herbal supplements, massage therapy, relaxation/imagery) and whether or not they help
    - **Previous therapy:** Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful
    - **Aggravating/easing factors:** Document factors such as time of day or length of time prior to exacerbating/alleviating symptoms. The Symptom Alleviation: Self-Care Methods (SA:SCM) can be used to identify ways that parents may help children alleviate chemotherapy-related symptoms
    - **Body chart:** Use body chart to document location and nature of symptoms
    - **Nature of symptoms:** Document nature of symptoms (e.g., constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling)
    - **Rating of symptoms:** Use a pain scale to assess symptoms, such as pain and fatigue, at their best, at their worst, and at the moment
Oucher scale – pain self-report for children aged 3 years and older

FLACC (which stands for face, leg, activity, cry and consolability) – pain assessment tool used for children; observes facial expression, leg movement, activity, cry and consolability

- **Pattern of symptoms:** Document changes in symptoms throughout the day and night; also document changes in symptoms due to weather or other external variables
- **Sleep disturbance:** Document number of wakings/night; ask if pain is interfering with sleep
- **Other symptoms:** Document other symptoms patient may be experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician. Other common symptoms include fatigue, pain, muscle weakness, dizziness, nausea, and dyspnea
  - Document side effects from cancer treatments
- **Respiratory status:** Document if child requires any supplemental oxygen and, if so, how much. Document if child has any respiratory conditions
- **Barriers to learning**
  - Are there any barriers to learning? Yes ☐ No ☐
  - If Yes, describe _________________________

Central nervous system therapy (cranial irradiation or intrathecal administration of chemotherapy) has been linked to learning disabilities and decreased IQ, especially in children under age 5 years.

Ask parent/caregiver about speech/language disorders that may impact patient’s ability to communicate needs

**Medical history**

- **Past medical history**
- **Previous history of same/similar diagnosis**
- **Comorbid diagnoses:** Ask patient and/or primary caregiver about other problems, including diabetes, renal disease, liver disease, anemia, heart disease, psychiatric disorders, orthopedic disorders, skin disease, graft-versus-host disease (GVHD), etc.
  - Thrombocytopenia, anemia may be present
- **Medications previously prescribed:** Obtain a comprehensive list of medications prescribed and/or being taken (including over-the-counter drugs, herbal and dietary supplements)
  - Common side effects of chemotherapy include hair loss, peripheral neuropathy, thrombocytopenia, fatigue, anemia, and function-limiting anxiety and fear

Other symptoms: Ask patient and/or primary caregiver about other symptoms patient may be experiencing

  - Common side effects of chemotherapy and/or radiation treatment
    - Hair loss
    - Peripheral neuropathy – burning, tingling pain, can cause wrist drop or foot drop
    - Thrombocytopenia
    - Fatigue
    - Anemia
    - Oral mucositis (inflammation of mucous membranes in digestive tract)
    - Dysphagia (difficulty swallowing)
    - Salivary dysfunction
    - Lymphedema
    - Impaired sensation
    - Impaired cognition
    - Vision problems
    - Problems with hearing
    - Depression
    - Impairment in motor function and bowel and bladder function
    - Common side effects of bone marrow transplantation include skin disorders (see Clinical Review... Bone Marrow Transplantation in Children, referenced above)
    - Post-traumatic stress disorder (PTSD) may be present in survivors of childhood cancer
    - Based on a study conducted in the United Kingdom involving 108 survivors of childhood cancer. 13.9% of survivors had symptoms that indicated a clinical diagnosis of PTSD

**Social/occupational history**

- **Patient’s goals:** Document what the patient and/or primary caregiver hopes to accomplish with therapy and in general
  - Perspective of patient is important in functional evaluations
- **Vocation/avocation and associated repetitive behaviors, if any:** Identify patient’s past participation in recreational, leisure, and sport activities; hobbies; and special interests. Identify patient’s participation in school, group, or religious activities
- **Functional limitations/assistance with ADLs/adaptive equipment:** Identify if patient requires the use of adaptive equipment and/or mobility devices for home and school
- **Living environment:** Identify number of stairs/number of floors in home, with whom patient lives, caregivers, etc. Identify if there are barriers to independence in the home and if any home modifications are necessary

**Relevant tests and measures:** (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting)
• Arousal, attention, cognition (including memory, problem solving)
  – Assess orientation, attention, problem-solving skills
  – Assess memory – short-term, long-term, and immediate. Immediate memory can be tested through copying tasks of an image by memory, repeating information immediately after hearing it, or solving math equations without pen/paper
• Assistive and adaptive devices
  – Assess use and appropriate fit of assistive and adaptive equipment
• Balance
  – Balance would be affected in the child with a brain tumor located in the cerebrum. Tests for balance could include:
    › Pediatric Balance Scale – assesses sitting balance, standing balance, sit to stand, stand to sit, transfers, stepping, reaching forward, reaching the floor, turning, stepping on and off elevated surfaces, functional reach(18)
    › Bruininks-Oseretsky, 2nd edition (BOT-2) balance subscale – test of motor proficiency for both gross motor and fine motor skills(19)
• Cardiorespiratory function and endurance
  – Assess activity tolerance for functional activities
  – Measure heart rate and blood pressure in supine, sitting, and standing due to possible orthostatic hypotension (see Clinical Review… Bone Marrow Transplantation in Children, referenced above)
• Circulation
  – Check for edema, which can be a side effect of radiation therapy.(8) Measure girth of edema
• Cranial/peripheral nerve integrity:
  – Cranial nerve testing as indicated
• Functional mobility (including transfers, etc.): Assess basic ADLs and level of assistance required to safely and independently perform skills such as transfers, bed mobility, grooming, dressing, toileting, etc.
• Joint integrity and mobility: Assess upper extremity and lower extremity joint integrity. Are there any joint capsule or fascial restrictions? Is the patient at risk for, or already developing upper extremity or lower extremity joint contractures?
• Motor function (motor control/tone/learning)
  – Assess upper extremity and lower extremity muscle tone
  – Indicate abnormality or asymmetry
  – Assess fine motor and gross motor function as deficits may arise from the disease, side effects of treatment, or prolonged hospitalization(20)
• Muscle strength
  – Manual muscle testing (MMT) of upper and lower extremities
  – Assess trunk strength
• Neuromotor development
  – Developmental screening assessments(20)
    › The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) can be used(20)
  – Longitudinal developmental assessments important for educational placement of patients(21)
• Observation/inspection/palpation (including skin assessment): Assess for skin lesions or rashes, document presence and location of them in children who have undergone bone marrow transplantation. Indicate if skin lesions impair joint mobility. Comment on severity of skin breakdown
• Perception (e.g., visual field, spatial relations)
  – Visual perceptual assessments(20)
    › Bruininks-Oseretsky (BOT-2) visual motor subscale(19)
    › Test of Visual-Perceptual Skills
    › Motor-Free Visual Perceptual Test
• Range of motion:
  – Assess passive ROM and/or active ROM for bilateral upper and lower extremity ROM for functional activities
• Reflex testing:
  – Assess bilateral C5, C6, C7, L4, and S1 and note any abnormality
• Self-care/activities of daily living (objective testing)
  – Childhood cancer survivors are more likely to report decreased ability to perform self-care tasks and difficulty with school(22)
  – Specific self-care/ADL tests used depend on treatment setting and degree of functional impairment
    › FIM(16) for functional activities for children over age 7 years
    › WeeFIM(16) for children under than age 7 years to measure degree of disability in daily activities
    › Modified Barthel Index(23) assesses functional activities such as eating, dressing, bathing, mobility, and bowel/bladder function
• Sensory testing
  – Check for visual impairment, which can be a side effect of radiation therapy(8)
    › Hirschberg technique – fixation on a pen light and observing light reflection in eyes(24)
    › Cover test – focus on a central target with one eye covered to see if uncovered eye can fixate(24)
    › Saccades – alternate fixating between two objects 6 inches apart, 16 inches from bridge of nose(24)
    › Tracking test – moving a pen light or target through 9 gaze positions to observe speed, coordination, and ROM in eyes(24)
    › Convergence test – moving a pen light toward the bridge of nose until it reaches point of convergence, usually 3 inches from bridge of nose(24)
    › Target and fixation – patient visually locates and fixates on a target(24)
  – Observe responses to auditory stimulation in the environment and whether responses to auditory stimuli are appropriate as auditory impairment can be a side effect of radiation therapy(8)
    – Skin testing for touch, temperature, and pain
• **Special tests specific to diagnosis**
  – Pediatric Quality of Life Inventory (PedsQL)\(^{16}\) to assess quality of life qualitatively
  – 5-point Likert scale for the categories of: physical, emotional, social and school functioning\(^{23}\)
  – Life Situation Scale for Children (LSS-C)\(^{25}\) to identify physical problems and assess psychosocial function
  – Toronto Extremity Salvage Score (TESS)\(^{25}\)
    ‣ Self-report; assesses physical function in patients with bone tumors over age 12\(^{25}\)
  – Pediatric Outcomes Data Collection Instrument (PODCI)\(^{16}\)
    ‣ Self-report; assesses change in physical function of children with orthopedic conditions\(^{16}\)
  – Activities Scales for Kids\(^{16}\) to describe and evaluate change in physical function in children with musculoskeletal conditions
  – Behavioral, Affective and Somatic Experiences Scale (BASES) to assess patient adjustment to illness across 5 subscales: somatic distress, mood disturbance, compliance, activity, and quality of life interactions\(^{10}\)
  – Therapy-Related Symptom Checklist for Children (TRSC-C)\(^{11}\) to record symptom severity/occurrence

**Assessment/Plan of Care**

### Contraindications/precautions

- **Patients with this diagnosis are at risk for falls;** follow facility protocols for fall prevention and post fall prevention instructions at bedside, if inpatient. Ensure that patient and family/caregivers are aware of the potential for falls and educated about fall prevention strategies. Discharge criteria should include independence with fall prevention strategies. Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician
  - Children with brain tumors are at risk for fluid buildup on the brain and may therefore be on fluid restriction. Be sure to check with the patient’s physician about fluid precautions\(^{4}\)
  - Children with brain tumors are also at risk for seizures\(^{4}\)
  - The summary below is meant to serve as a guide, not to replace orders from a physician or a clinic’s specific protocols
  - It is extremely important to be in direct communication with the physician and nursing staff regarding the patient’s course of treatment and what contraindications are in place (e.g., platelet counts, fever, bone marrow biopsy test)

### Diagnosis/need for treatment

- As prescribed by physician
- Therapeutic intervention is appropriate for the following: loss of premorbid functional status and/or age-appropriate gross motor skills, decreased cardiorespiratory endurance, shortness of breath with ambulation or functional mobility, impaired balance, complaints of musculoskeletal pain, contracture prevention/management, atypical muscle tone, and gait abnormality
- For strengthening and conditioning, maintenance of self-care and play activities, adaptive equipment for functional activities while undergoing cancer treatment\(^{13}\)

### Rule out

- The differential diagnoses for leukemia includes aplastic anemia and infectious mononucleosis
- The differential diagnoses for lymphoma includes influenza, infectious mononucleosis, HIV infection, and Epstein-Barr virus infection
- The differential diagnoses for neuroblastoma includes osteomyelitis, rheumatoid arthritis, and primary neurologic disease
- The differential diagnoses for Wilms tumor includes renal cyst, hydronephrosis, and polycystic kidney disease
- The differential diagnoses for retinoblastoma includes glaucoma, strabismus, and leukokoria
- The differential diagnoses for sarcoma includes cysts, aggressive fibromatosis, and dermatofibroma

### Prognosis

- Prognosis depends on type and stage of cancer
- Prognosis for neuroblastoma depends on the site of the tumor and is also age related: the lower the age, the better the prognosis\(^{4}\)
- Prognosis for Wilms tumor depends on the stage of tumor at time of diagnosis
- In soft tissue sarcomas, children aged 1-7 years have a better chance of survival; prognosis depends on primary site of tumor, extent of disease, and cell growth pattern
- Prognosis for children with brain tumors depends on tumor’s location and type
- Patients with bone cancers have a 60-70% survival rate if tumor is localized; patients with primary tumors located in the distal bones do better than those with tumors located more proximally
  - Retinoblastoma prognosis is related to stage of tumor at time of diagnosis
  - Survival rate (5-year) of children with cancer is approximately 75%\(^{26}\)
  - Two thirds of survivors have a late effect of cancer that affects quality of life\(^{26}\)
  - One quarter of survivors have severe or life-threatening effects of cancer\(^{26}\)

### Referral to other disciplines

- Physician/oncologist for other symptoms or new symptoms
- Physical therapy
- Speech-language pathology for dysphagia as a result of cancer therapy
- Dentistry for oral complications of therapy\(^{15}\)
- Psychology for family/caregiver and patient support and coping
- Social work for family/caregiver and patient support and coping
- Ophthalmology for any vision impairment
- Audiology for any auditory impairment

- **Other considerations**
  - Physical performance limitations with childhood cancers vary depending on the type of malignancy and the type of treatments administered\(^{(22)}\)

- **Treatment summary**
  - Treatment intervention is more effective the earlier it is initiated following the initial cancer diagnosis
  - Occupational therapists can take on a supportive role assisting with the psychosocial and emotional needs of children with cancer. This appears to be beneficial for helping families and children cope with cancer\(^{(21)}\)
    - 49 patients: 28 boys, 21 girls aged 1-19 years who were receiving cancer treatment in a children’s hospital in Alabama, in the United States, were followed for a 12-month period\(^{(21)}\)
    - 20 patients had leukemia, 16 had solid tumors, and 13 had lymphoma\(^{(21)}\)
    - Initial interviews conducted with both parents and with patients over age 17 to identify psychosocial, emotional, or coping difficulties\(^{(21)}\)
    - Problems identified were lack of emotional support to accept diagnosis, depression, dealing with reactions of relatives, emotional support of patient, parent-child relationship, marital difficulties since onset of illness, sibling support, financial concerns, transportation costs, educational concerns, and cancer-related medical treatment concerns\(^{(21)}\)
    - The focus of occupational therapy intervention was on helping child and family become as independent as possible in managing burden of illness\(^{(21)}\)
    - Use of play sessions for child to express feelings, providing assistance with financial resources, and developmental screening assessments to determine child’s level of function
  - In a study involving 38 children and young adults (aged 4-25) with low-grade gliomas who received radiation therapy, researchers in India, found functional improvements in the areas of ambulation, personal hygiene, feeding, and stair climbing with rehabilitation intervention at 3-year follow-up. Rehabilitation intervention included environmental adaptation and building physical activity tolerance\(^{(23)}\)

### Problem | Goal | Intervention | Expected Progression | Home Program
--- | --- | --- | --- | ---
Decreased activity tolerance\(^{(20, 25)}\) for ADLs | Maximize independence with ADLs | **Patient and family education**<br>Education about energy-conservation techniques for ADLs | Progress patient as indicated | Provide patient and family/caregivers with written instructions regarding energy-conservation techniques and safe and proper use of adaptive equipment

| Decreased school participation/attendance due to cancer treatments\(^{(25)}\) | Increase participation in school/academic activities | **Activity modification**<br>Modification of activities, prescription of aids as needed for participation at school | Child/family will use modifications/adaptations for school participation, gradually increasing activities as patient improves | Provide patient, family/caregivers, and teachers with written instructions on modifications and adaptations for academic activities

| Decreased participation in sports/leisure activities due to central venous catheter for treatments\(^{(27)}\) | Maximize participation in sports/leisure activities | Prescription, application of devices and equipment Orthoses for protection of central venous catheter to allow children to resume activities safely\(^{(27)}\) | N/A | Provide patient and family/caregivers with written instructions regarding safe and proper use of orthoses

### Desired Outcomes/Outcome Measures

- **Desired outcomes**
  - Independence in self-care and age-appropriate activities\(^{(20)}\)
  - Improved coping skills and adjustment to illness for patient and family\(^{(20)}\)
  - Pain and fatigue management for functional activities\(^{(20)}\)
  - Maximization of age-appropriate gross and fine motor skills function\(^{(20)}\)
  - Improved overall quality of life\(^{(20)}\)

- **Outcome measures**
  - Quality of life measures
    - Pediatric Outcomes Data Collection Instrument (PODCI)\(^{(16)}\)
    - Activities Scales for Kids\(^{(16)}\)
    - Pediatric Quality of Life Inventory (PedsQL)\(^{(16)}\)
Maintenance or Prevention

- The U.S. Centers for Disease Control and Prevention (CDC) recommends the following to prevent cancers in children:28
  - Sun safety and protection
  - Human papillomavirus (HPV) vaccination
  - Prevent smoking and secondhand smoke exposure
- Continued follow-up with physician for medical care and management
- Home strengthening and conditioning
- In a study conducted in the United Kingdom of 108 survivors of childhood cancer, 13.9% of survivors had symptoms that indicated a clinical diagnosis of PTSD. The authors recommend that survivors of childhood cancers have psychological follow-up.17
- The Children’s Oncology Group has published long-term follow-up guidelines for survivors of childhood, adolescent, and young adult cancers. These guidelines are organized according to therapeutic exposures: any cancer experience, blood/serum products, chemotherapy, radiation, hematopoietic cell transplant, other therapeutic modalities, cancer and general health screening.29
- Home monitoring of symptoms for young people undergoing chemotherapy will be important for prevention of side effects that may be life threatening.
  - A pilot study in the United Kingdom indicated the feasibility of using mobile phone technology to record and send symptom reports back to the hospital for young people undergoing chemotherapy.30

Patient Education

- National Childhood Cancer Foundation, www.curesearch.org
- Leukemia and Lymphoma Society, www.leukemia.org
- National Cancer Institute, www.cancer.gov

Coding Matrix

References in this Clinical Review are rated using the following codes, listed in order of strength:

- **M** Published meta-analysis
- **SR** Published systematic or integrative literature review
- **RCT** Published research (randomized controlled trial)
- **R** Published research (not randomized controlled trial)
- **C** Case histories, case studies
- **G** Published guidelines
- **RV** Published review of the literature
- **RU** Published research utilization report
- **QI** Published quality improvement report
- **L** Legislation
- **PGR** Published government report
- **PP** Policies, procedures, protocols
- **X** Practice exemplars, stories, opinions
- **GI** General or background information/texts/reports
- **U** Unpublished research, reviews, poster presentations or other such materials
- **CP** Conference proceedings, abstracts, presentations

References

1. Burns CE, Dunn AM, Brady AM, Starr NB, Blosser CG. Pediatric Primary Care. 4th ed. St. Louis, MO: Saunders Elsevier; 2009. (GI)


