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This chapter introduces overview, treatment, common dysfunctions, physical therapy assessment, physical therapy, key points in diagnosis, and palliative care of following cancer types: breast cancer, gynecologic cancers, brain tumor, head and neck cancer, lung cancer, esophagus cancer, bone cancer, and blood cancer. This chapter also shows the important role of physical therapy in cancer patients.

2. General concept of physical therapy

Physical therapists must undergo assessment based on the International Classification of Functioning, Disability and Health (ICF) model before, during, and after physical therapy for each cancer patient (Figure 2). ICF enables physical therapist to provide cancer patients with therapy. Cancer patients have many problems caused by cancer treatment or cancer itself. Physical therapy assessment should include manual muscle testing (MMT), range of motion (ROM), balance test, endurance test, and ADL test. Performance status (PS; Table 3) [8], Palliative Performance Scale (PPS; Table 4) [9], Barthel index (BI) [10], functional independence measure (FIM) [11, 12], and QOL are also used as assessment tools for cancer patients. Physical therapists should be aware that cancer patients are exposed to various risks such as infectious diseases due to immunosuppressive effects of the treatment. Thus, physical therapists must manage risks that are related to cancer and its treatment (Table 5) [13]. Additionally, physical therapists must recognize that cancer is a progressive disease. In general, cancer patients have a gradual decline in their physical function. Once a goal is set, physical therapists must be aware of cancer progression and patients’ prognosis [14]. Physical therapists also must know a variety of other problems that occur in cancer patients. Cancer patients might not only have physical function problems but may also develop depression and anxiety in the future [15]. Cancer patients might feel the fear of cancer recurrence or death. Physical therapy may be effective in reducing fatigue, increasing muscle strength and exercise capacity, and improving QOL in various cancer patients.

Table 2. Four cancer rehabilitation stages.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Preventive</td>
<td>Intervention focused on improving the patient’s level of function prior to the onset of the effects of the cancer and its treatment, patient education, and psychological support</td>
</tr>
<tr>
<td>(2) Restorative rehabilitation</td>
<td>Intervention focused on returning the patient to a previous level of function and addressing impairments from cancer and its treatment</td>
</tr>
<tr>
<td>(3) Supportive rehabilitation</td>
<td>Intervention is meant to assist the cancer patient to function at the highest level within the context of his or her impairments, activity limitations, and participation restrictions</td>
</tr>
<tr>
<td>(4) Palliative rehabilitation</td>
<td>Intervention focused on minimizing complications such as pressure ulcers, contractures, and muscle deconditioning ensuring adequate pain control and emotional support for the family</td>
</tr>
</tbody>
</table>
Figure 2. International Classification of Functioning, Disability, and Health.

Grade | ECOG performance status
--- | ---
0 | Fully active, able to carry on all pre-disease performance without restriction
1 | Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light house work, office work
2 | Ambulatory and capable of all self-care but unable to carry out any work activities. Up and about more than 50% of waking hours
3 | Capable of only limited self-care, confined to bed or chair more than 50% of waking hours
4 | Completely disabled. Cannot carry on any self-care. Totally confined to bed or chair
5 | Dead

Table 3. Performance status (PS).

<table>
<thead>
<tr>
<th>PPS level</th>
<th>Ambulation</th>
<th>Activity and evidence of disease</th>
<th>Self-care</th>
<th>Intake</th>
<th>Conscious level</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Full</td>
<td>Normal activity and work no evidence of disease</td>
<td>Full</td>
<td>Normal</td>
<td>Full</td>
</tr>
<tr>
<td>90</td>
<td>Full</td>
<td>Normal activity and work Some evidence of disease</td>
<td>Full</td>
<td>Normal or reduced</td>
<td>Full</td>
</tr>
<tr>
<td>80</td>
<td>Full</td>
<td>Normal activity with effort Some evidence of disease</td>
<td>Full</td>
<td>Normal or reduced</td>
<td>Full</td>
</tr>
<tr>
<td>70</td>
<td>Reduced</td>
<td>Unable normal job/ work Significant disease</td>
<td>Full</td>
<td>Normal or reduced</td>
<td>Full</td>
</tr>
<tr>
<td>60</td>
<td>Reduced</td>
<td>Unable hobby/house work Significant disease</td>
<td>Occasional assistance necessary</td>
<td>Normal or reduced</td>
<td>Full or confusion</td>
</tr>
<tr>
<td>PPS level</td>
<td>Ambulation</td>
<td>Activity and evidence of disease</td>
<td>Self-care</td>
<td>Intake</td>
<td>Conscious level</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------</td>
<td>----------------------------------</td>
<td>-------------------------</td>
<td>----------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>50</td>
<td>Mainly sit/lie</td>
<td>Unable to do any work</td>
<td>Considerable assistance</td>
<td>Normal or reduced</td>
<td>Full or confusion</td>
</tr>
<tr>
<td></td>
<td>Extensive disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Mainly in bed</td>
<td>Unable to do most activity</td>
<td>Mainly assistance</td>
<td>Normal or reduced</td>
<td>Full or drowsy ± confusion</td>
</tr>
<tr>
<td></td>
<td>Extensive disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Totally bed bound</td>
<td>Unable to do any activity</td>
<td>Total care</td>
<td>Normal or reduced</td>
<td>Full or drowsy ± confusion</td>
</tr>
<tr>
<td></td>
<td>Extensive disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Totally bed bound</td>
<td>Unable to do any activity</td>
<td>Total care</td>
<td>Minimal to sips</td>
<td>Full or drowsy ± confusion</td>
</tr>
<tr>
<td></td>
<td>Extensive disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Totally bed bound</td>
<td>Unable to do any activity</td>
<td>Total care</td>
<td>Mouth care only</td>
<td>Drowsy or coma ± confusion</td>
</tr>
<tr>
<td></td>
<td>Extensive disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Death</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1PPS scores are determined by reading horizontally at each level to find a “best fit” for the patient who is then assigned as the PPS% score.

2Begin at the left column, read downward until the appropriate ambulation level is reached, and then read across to the next column and downward again until the activity/evidence of disease is located. These steps are repeated until all five columns are covered before assigning the actual PPS for that patient. In this way, “leftward” columns (columns to the left of any specific column) are “stronger” determinants and generally take precedence over others.

3PPS scores are in 10% increments only. Sometimes, there are several columns easily placed at one level but one or two which seem better at a higher or lower level. One then needs to make a “best fit” decision. Choosing a “halfwit” value of PPS 45%, for example, is not correct. The combination of clinical judgment and “leftward precedence” is used to determine whether 40% or 50% is the more accurate score for that patient.

Table 4. Palliative Performance Scale (PPSv2).

1. Hematologic profile: hemoglobin <7.5 g, platelets <20,000, white blood cell count <3000
2. Metastatic bone disease
3. Compression of a hollow viscous (bowel, bladder, or ureter) vessel or spinal cord
4. Fluid accumulation in the pleura, pericardium, abdomen, or retroperitoneum associated with persistent pain, dyspnea, or problems with mobility
5. CNS depression or coma or increased intracranial pressure
6. Hypokalemia/hyperkalemia, hyponatremia, or hypocalcemia/hypercalcemia
7. Orthostatic hypotension
8. Heart rate in excess 110 beat/min or ventricular arrhythmia
9. Fever greater than 101°F

Table 5. Precaution rehabilitation for cancer patients.
3. Physical therapy in cancer patients

3.1. Breast cancer

3.1.1. Overview

Breast cancer is the most common invasive cancer in women worldwide [16]. Breast cancer alone accounts for 25% of all cancer cases and 15% of all cancer deaths among women [17]. Breast cancer starts when cells in the breast begin to grow out of control. These cells usually form a tumor that can be often seen on an X-ray or felt as a lump. Breast cancer can develop following changes in genetic material leading to cellular changes that causes cells to start multiplying in an uncontrolled fashion, forming lumps or nodules.

3.1.2. Treatment

In general, breast cancer patients have few treatment options such as surgery (breast-conserving surgery and mastectomy), radiation therapy, chemotherapy, and hormone therapy [18, 19]. In some cases, lymph nodes located close to the affected breast need to be surgically removed.

3.1.3. Common dysfunctions in breast cancer

Muscle weakness around the shoulder joint, decline of ADL using upper extremities, dizziness, loss of appetite, shortness of breath, depression are present in a substantial majority of patients during or after their initial treatment (surgery, radiation, and/or chemotherapy) [20, 21]. Physical therapists must pay attention to the occurrence of musculoskeletal disorders and lymph vascular disorders following breast surgery. Musculoskeletal disorders include postsurgical pain, rotator cuff disease, and adhesive capsulitis [22]. Lymph vascular disorders are common after removal of lymph nodes [23]. As a result, breast cancer patients have limited range of motion, muscle weakness, pain, and ADL decline such as difficulties while brushing hair or taking off the jacket. In some cases of breast cancer, cellulitis occurs that can become a potentially serious bacterial skin infection [21, 24].

3.1.4. Physical therapy assessment

Physical therapy assessment of cancer patients includes the ICF, examination of shoulder ROM, MMT, pain levels, fatigue, upper limb volume, an upper limb disability questionnaire, and QOL evaluation. Additionally, in the cases of breast cancer patients, physical therapists assess exercise tolerance.

3.1.5. Physical therapy

Many previous studies showed that physical therapy has effectiveness in breast cancer patients [25, 26]. In general, combined physical therapy is effective to treat postoperative lymphedema,
pain, and impaired ROM after treatment for breast cancer [26]. Physical therapy for breast cancer patients includes lymphatic drainage massage, vantage, manual stretching, myofascial therapy, relaxation massage, stretching, strengthening, resisted exercise, proprioceptive neuromuscular facilitation (PNF) exercises, isometric exercises, aerobic exercises, transcutaneous electrical nerve stimulation (TENS), heat and cold, patient education, and behavioral training. Breast cancer patients also receive ADL training such as bathing, showering (washing the body), and dressing.

3.1.6. Key points

Physical therapists should improve mobility of upper extremities with a reduction of their volume. This should be followed by an attempt to recover upper limb function in ADL.

3.2. Gynecologic cancers

3.2.1. Overview

Gynecologic cancers accounted for 19% of the 5.1 million estimated new cancer cases and 13 million 5-year prevalent cancer cases among women in the world in 2002 [27]. Gynecologic cancer is described as the uncontrolled growth and spread of abnormal cells originating in the female reproductive organs. They are found in different places within a woman’s pelvis, which is the area below the stomach and in between the hip bones. Five main types of gynecologic cancers are present: cervical, ovarian, uterine, vaginal, and vulvar.

3.2.2. Treatment

In general, gynecologic cancers can be cured with aggressive treatment involving surgery, chemotherapy, and/or radiation. Treatment goal in recurrent and metastatic cancer is to decrease progression of the disease [28, 29].

3.2.3. Common dysfunctions in gynecologic cancer

Weakness of pelvic floor muscles, decline in ADL, dizziness, loss of appetite, shortness of breath, depression are the symptoms present in a substantial majority of patients during or after their initial treatment (surgery, radiation, and/or chemotherapy) [30]. Lower extremity weakness often occurs in gynecologic cancer patients; thus, locomotion disability is common [31]. Physical therapists must pay attention to occurrence of musculoskeletal and lymph vascular disorders at the lower extremities following gynecologic surgery [32]. Lymphovascular disorders cause problems after removal of lymph nodes [33]. As a result, patients experience limited ROM, muscle weakness, pain, and decline in ADL.

3.2.4. Physical therapy assessment

First, physical therapists should assess pelvic floor muscle strength as gynecologic cancers have urinary incontinence after the treatment [34, 35]. Second, physical therapists should
assess ICF category: lower extremities such as hip, knee, and ankle ROM; MMT; assessment of pain levels; fatigue; upper limb volume; locomotion ability such as gait speed; balance function; QOL; ADL; and sexual function [36]. Additionally, physical therapists should assess exercise tolerance.

3.2.5. Physical therapy

A few previous reports showed that physical therapy has a positive effect on gynecologic cancer patients [37]. Physical therapists should perform pelvic floor physical therapy as a tool to aid in addressing pelvic floor symptoms [37]. In general, physical therapy for gynecologic cancer patients includes locomotion ability exercises such as standing and walking, lymphatic drainage massage, vantage, manual stretching, myofascial therapy, relaxation massage, stretching, strengthening, resisted exercise, PNF, aerobic exercise, TENS, patient education, and behavioral training.

3.2.6. Key points

Physical therapists should improve muscle strength of lower extremities and reduce their volume as soon as possible. This should be followed by acquiring locomotion.

3.3. Brain tumor

3.3.1. Overview

The worldwide cancer incidence of a malignant brain tumor is 3.4 per 100,000 for men and 3.0 per 100,000 for women [38]. Brain tumor is the most common neurological complication related to cancer [39]. Brain tumors can originate from the patient’s brain (primary brain tumors) or from other parts of the patient’s body (secondary or metastatic brain tumors) [40, 41]. Brain tumors can destroy brain cells, increase inflammation, and elevate brain pressure. Brain tumors may cause a wide range of neurological dysfunctions, including disorders of the nervous system.

3.3.2. Treatment

In general, treatment options include surgery, radiation therapy, chemotherapy, targeted biological agents, or a combination of these [42]. Surgical resection is commonly the first recommended treatment in order to rapidly reduce brain pressure.

3.3.3. Common dysfunctions in brain tumor

Brain tumor patients commonly experience weakness, sensory loss, and abnormal muscle tone. These include spasticity, visuospatial deficits, hemi-neglect or bilateral visual deficits, ataxia, cognitive deficits (thought processes, memory changes, apraxia, etc.), speech difficulties, dysphagia, bowel and bladder dysfunction, psychological problems, and fatigue. As a result, ADL decline and lower QOL are common in brain tumor patients [43, 44].
3.3.4. Physical therapy assessment

Physical therapists often assess ICF category, Glasgow Coma Scale, Mini-Mental State Examination, Fugl-Meyer, Motor Assessment Scale, Motricity Index, Berg Balance Assessment, Beck Depression Inventory (BDI), and Hospital Anxiety and Depression Scale (HADS). They examine pain levels and locomotion ability such as gait speed, QOL, and sexual function. Additionally, physical therapists should assess exercise tolerance in brain tumor patients [45, 46].

3.3.5. Physical therapy

To date, no previous study has reported positive effects of physical therapy in adult brain tumor patients. However, a few reports showed that physical therapy may be effective in pediatric brain tumor patients [47]. In general, physical therapy performed in brain tumor patients is also performed in stroke patients [48]. It includes neurofacilitation techniques such as Bobath, PNF, Brunnstrom, motor relearning, functional electrical stimulation (FES), biofeedback, balance retraining, gait reeducation, and use of supportive equipment. Physical therapists must be aware of the progress of paralysis in brain tumor patients as a result of increasing tumor size. Physical therapists should know how to improve convalescence of the brain. Additionally, cognitive dysfunction, apraxia, and aphasia should be assessed [49].

3.3.6. Key points

Physical therapists should aim to treat paralysis and improve ADL as soon as possible. Attention should be paid to progressive paralysis in brain tumor patients.

3.4. Head and neck cancer

3.4.1. Overview

Overall, the annual incidence of head and neck cancer worldwide is more than 550,000 cases with around 300,000 deaths [50]. Men are affected significantly more than women [51]. Head and neck cancer includes cancers of the mouth, nose, sinuses, salivary glands, throat, and lymph nodes in the neck. Most originate from the moist tissues that line the mouth, nose, and throat. Head and neck cancers can also originate within the salivary glands. Salivary glands contain many different types of cells that can become cancerous leading to many different types of salivary gland cancers.

3.4.2. Treatment

Treatment options include surgery, radiation therapy, chemotherapy, and targeted therapy [52]. Surgery or radiation therapy alone or a combination of these treatments may be part of a patient’s treatment plan [53]. Tracheostomy is performed when there are concerns about breathing due to airway obstruction associated with a throat cancer or treatment side effects [54]. Nutritional status of patients declines following tracheostomy. As patients are not able to eat, they usually receive intravenous feeding.
3.4.3. Common dysfunctions in head and neck tumor

Aspiration pneumonia after concurrent chemoradiation therapy and surgery is seen in head and neck cancer patients [55]. Most patients have dysphagia and are at increased risk of having aspiration and subsequent pneumonia [56]. Additionally, physical therapists must be aware of the decline in nutritional status after surgery or chemoradiation in these patients [57]. Paralysis of accessory nerve that causes trapezius muscle dysfunction is often seen following neck dissection [58]. This dysfunction leads to shoulder syndrome with adhesive capsulitis. Muscle weakness, decline of ADL, dizziness, loss of appetite, shortness of breath, depression are observed in a substantial majority of patients during or after their initial treatment (surgery, radiation, and/or chemotherapy) [59]. Upper and lower extremities tend to be weaker following long-term bedridden and sedentary treatment.

3.4.4. Physical therapy assessment

General pulmonary function tests are performed: spirometry; breathing pattern and cough; breath sounds including wheezing, coarse crackles, fine crackles, and rhonchi; and posture deformities in the chest or the spine; dysphagia evaluation; and ADL. Additionally, physical therapists should perform exercise tolerance test in gynecologic cancer patients. Furthermore, physical therapists should assess shoulder function including strength, mobility, and pain after surgery or chemoradiotherapy. Physical therapists often assess ICF category and lower and upper joint ROM; perform MMT; and evaluate pain levels, fatigue, and locomotion ability such as gait speed, balance function, and QOL.

3.4.5. Physical therapy

Physical therapy of the arms is performed to improve locomotion and pulmonary dysfunction. Some previous reports showed that physical therapy has effectiveness in head and neck cancer patients [60, 61]. When patients have paralysis of the accessory nerve, physical therapists perform exercises for the trapezius muscle to reduce its dysfunction [62]. Additionally, physical therapy of head and neck cancer patients includes locomotion ability exercises such as standing and walking, massage, manual stretching, myofascial therapy, relaxation massage, stretching, strengthening, resisted exercise, PNF, aerobic exercise, TENS, patient education, and behavioral training [63, 64]. However, if patients are fasting and have aspiration, they may have lower nutritional status requiring physical function recovery to be delayed.

3.4.6. Key points

Physical therapists must recognize that head and neck cancer patients tend to experience decline of the pulmonary function and paralysis of accessory nerve following the neck surgery. Physical therapists should recover pulmonary and shoulder function and improve ADL in such patients.


