The Effect of Cancer Diagnosis and Treatment on Hand Function

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A variety of sensorimotor and functional hand problems can be related to cancer. The problems can be caused by cancer treatment interventions of chemotherapy, radiation therapy, or surgery, or can result from the effects of a primary cancer condition or from metastatic disease. The treatment goals for these dysfunctions are interconnected with the expected prognosis for the cancer condition. They may be preventative, restorative, supportive, or palliative (Carter, Glatsen, & Livingston, 1982; Bierenger, 1981). Depending on the patient’s prognosis and stage of illness, knowledge of the disease process and medical treatment model will directly influence the occupational therapist’s treatment goals and choices.

The definition of cancer-related hand function problems and the treatment of these problems has been neglected in the rehabilitation literature. Romsaas and Rosa (1985) have discussed occupational therapy interventions for patients with metastatic disease. Bierenger (1981) has discussed the side effects of chemotherapeutic agents and radiation with brief mention of some general treatment interventions (i.e., range of motion, strengthening, activities of daily living [ADLs]). This article discusses the effects of cancer treatment and disease on hand functioning and provides a framework for clinical reasoning for the treatment of cancer-related hand dysfunction.

Effects of Chemotherapy

Peripheral neuropathy caused by chemotherapy is a common problem resulting from cancer treatment and is brought about by the administration of high (toxic) doses of several chemotherapeutic drugs (Holden & Felde, 1987; Ostchega, Donohue, & Fox, 1988). Causal agents include vincristine sulfate, cisplatin, vindesine, vinblastine sulfate, procarbazine hydrochloride, hexamethylmelamine, or misonidazole (Casciato & Lowitz, 1988; Pain Service, Department of Neurology, Memorial Sloan-Kettering Cancer Center, 1985). These drugs cause demyelination of nerve fibers and affect large-fiber sensory nerves (Ostchega et al., 1988; Siegal & Haim, 1990). Patients often experience muscle cramps or electric shock sensations or both in their limbs (Lhermitte’s sign), which is suggestive of damage to the posterior column or the spinal dorsal nerve column (Siegal & Haim, 1990). Severity of symptoms is often related to the dose prescribed and general toxicity of the specific agent used.

Damage to peripheral nerve fibers may result in a stocking-glove distribution of sensory change, which is caused by a denervation of distal peripheral sensory nerve fibers. Partial denervation results in paresthesias, hyperesthesias, complaints of clumsiness when attempting to sustain a grip, and impairment or loss of proprioception (Holden & Felde, 1987). These symptoms can lead to decreased use of the hands for functional tasks,
weakness and atrophy of intrinsic and extrinsic muscle groups, loss of integrity of the palmar arches, decreased joint range of motion, and increased risk of injury due to sensory changes.

When chemotherapy is at maximal dose level, peripheral neuropathies produced by the chemotherapy treatment are full-blown. Needle electromyography (EMG) and nerve conduction studies (NCSs) are usually not done because of decreased platelet levels and the inherent risk of hemorrhage caused by the chemotherapy (i.e., with agents such as cisplatin and vincristine) (Marshall, Marshall, Vos, & Chestnut, 1990). Additionally, these neuropathies usually resolve to some degree, which varies among persons as the drug is metabolized and after treatment ceases (Siegal & Haim, 1990). Therefore, accurately forecasting the probability of return of hand sensation and function is difficult.

Because the prognosis for the return of peripheral nerve function is good for many of these patients, they tend to respond well to sensory reeducation and desensitization treatment techniques. Factors such as the relationship between speed of return of nerve function and the use of sensory reeducation and desensitization techniques have not been examined in this population. We have found that exposure to varied textures, vibration, massage, and compression with toner gloves can provide sensory input and relief from burning hyperesthesias. Symptom-specific static splints with soft linings and straps can prevent deformity and injury. A home exercise program and activities can be prescribed to maintain strength and range of motion. If the ability to perform ADLs is affected, assistive devices and compensatory techniques can also be prescribed.

For instance, for one patient with hyperesthesia, impaired proprioception, and complaints of dropping objects, who enjoyed needlework, the occupational therapist taped the index and middle fingers together to enable better control of a needle and cloth. Goals for treatment were concurrently supportive and preventative. This activity was supportive, because it allowed function by use of adaptation, and also preventative, because the adaptation allowed the person to participate in the activity, thus preventing feelings of loss and despair often associated with an inability to perform valued activities.

**Effects of Radiation**

Oncology patients commonly experience radiation-induced brachial plexopathy if radiation is received near the area of the brachial plexus (i.e., with breast, head, and neck, or lung cancers). Plexus damage occurs most commonly at the cervical 5-6 spinal cord level due to fibrosis from high doses of radiation (> 6000 rads) (Barr & Kissin, 1987; Casciato & Lowitz, 1988). Radiation plexopathy can occur 4 to 24 months after completion of radiation treatment and is irreversible. Computerized axial tomography (CAT) scanning is required for determination of a diagnosis. Clinical symptoms include paresthesias in the little finger that spread to the remainder of the hand, pain radiating from the axilla to the little finger, sensory loss of the ulnar distribution of the upper extremity, atrophy of the intrinsic hand muscles, lymphedema, and progressive proximal to distal upper extremity weakness (Casciato & Lowitz, 1988). These symptoms can lead to decreased function of the entire upper extremity, particularly the hand.

Hand therapy for this irreversible condition is based on (a) palliative goals—providing positioning or edema control techniques to improve comfort at rest and during activity, (b) preventative goals—positioning to prevent subluxation or deformity, or (c) supportive goals—providing a dynamic splint or activity adaptation that supports independent function. Clinical management often includes range of motion of the entire limb, patient education on safety and protection of the desensitized hand, positioning of the upper extremity with slings for comfort or protection, edema control techniques, static and dynamic splinting of the hand, and provision of assistive devices and instruction in compensatory techniques for ADLs.

One person we treated was a 68-year-old, right-handed woman with end-stage breast cancer and radiation-induced brachial plexopathy, whose goal was to write a brief letter. The patient was depressed over her inability to use her dominant hand for writing and other important activities. She presented with right-handed intrinsic muscle atrophy, shortened wrist flexors, hyperesthesia, marked radial nerve distribution sensory loss (particularly over the snuff box area), and mild wrist drop. Because the patient had radial, ulnar, and median nerve involvement, she was provided with a dynamic wrist and digital extension assist with an opponens component. Using the splint, she was able to hold a pen and write a brief letter. Treatment goals were both preventative, by splinting to prevent wrist drop and reflexive pain; and palliative, by providing an adaptation to a specific activity choice to enable writing.

Radiation can also induce peripheral nerve damage, which is a common occurrence in patients who receive radiation treatment in the upper extremity. A tumor or peripheral nerve atrophy near the area of irradiation generally occurs several to many years after treatment. Radiation has been shown to be toxic to peripheral nerves, affecting the connective tissue and blood supply of the nerves rather than the nerve itself (Foley, Woodruff, Ellis, & Posner, 1980). Again, because the sequelae are irreversible, treatment goals focus on supportive, preventative, and palliative outcomes. Patients commonly develop intrinsic muscle atrophy, hyperesthesia, paresthesia, and decreased range of motion, which is specific to the peripheral nerve involved. For example, a 17-year-old girl with malignant fibrosarcoma of the left forearm under-
went localized radiation therapy. As a result, she experienced a claw hand posture due to irreversible ulnar nerve damage. Treatment included preventative measures such as a dynamic splint that provided wrist support, blocked the ring and little finger metacarpophalangeal joints, and assisted interphalangeal extension, as well as scar management with silicone gel.

Direct Effects of Cancer Disease

Hand dysfunction can also result from the actual cancer disease process, due to primary tumors or metastatic disease. For instance, neurological cancers (brain or spinal cord) and myelomas are types of primary cancers that commonly cause hand dysfunction. Metastatic disease caused by breast or lung cancer can affect the brain, spinal cord, nerve roots, or peripheral nerve fibers and may impede hand function (Casciato & Lowitz, 1988).

Spinal Cord Involvement

Severity of hand impairment due to spinal cord tumors or metastatic disease of the spinal cord area depends on the level of the lesion, whether the mass is unilateral or bilateral, and whether it is located in the spinal canal (denoting an invasive cancer) (Casciato & Lowitz, 1988). Such tumors are usually excised via laminectomy and are managed with dexamethasone therapy and radiation (Casciato & Lowitz, 1988). Prognosis depends on location and type of mass; functional sequelae are similar to those of the patient with paraplegia or quadriplegia. Return or improvement of hand function is common after cancer treatment, meaning that restorative treatment goals in hand therapy are often appropriate.

Brain Tumors

The patient with a primary brain tumor or metastatic disease to the brain commonly develops hemiparesis with resultant decreased function of the upper extremity and hand. Hand therapy goals can often be restorative, depending on the overall prognosis, type, and location of the tumor. Neurodevelopmental treatment principles are successfully applied to this population, as they are with persons with cerebrovascular accident or brain injury. For example, a 78-year-old man with astrocytoma (a malignant, fast-growing brain tumor) responded favorably to NDT and Rood techniques use to facilitate body alignment and function of a flaccid upper extremity.

Myeloma

Plasma cell myeloma is a primary cancer that causes bone marrow pathology. Common results of the pathology are compression of the spinal cord and nerve roots and carpal tunnel syndrome due to amyloid infiltration of the flexor retinaculum of the wrist. (Amyloid is a protein normally found in the body that pathologically proliferates and deposits a proteinaceous substance in tissues and organs of the body in patients with myeloma.) Peripheral neuropathy can also develop in these patients due to amyloid infiltration of the peripheral nerves (Casciato & Lowitz, 1988).

Patients may also experience bone tenderness and pathological fractures. Prognosis for survival in patients with this diagnosis ranges from 2 to 3 years and depends on tumor mass and response to medical treatment. Hand therapy intervention is crucial for restoring or supporting function and includes gentle active range of motion, positioning and splinting for comfort and to prevent injury, and instruction in one-handed ADLs.

One case example is that of a 58-year-old man who incurred a pathological fracture of the humeral shaft of his dominant upper extremity. He was fitted with a fracture brace and sling and swathe, was instructed in pendulum exercises, and was provided with adapted kitchenware to enable him to participate in his favorite avocation, gourmet cooking.

Summary

Cancer diagnosis and treatment can have a profound effect upon hand function, presenting a challenge to the occupational therapist. The therapist who specializes in oncology or hand therapy must have knowledge of the medical treatment model in regard to cancer conditions and must be able to set realistic goals that consider the patient’s medical prognosis as well as the effect the disease or medical treatment has on the patient’s physical and emotional functioning. The challenge to therapists in this area of practice will be to conduct research to verify or validate the effectiveness of the occupational therapy interventions currently provided. As cancer is diagnosed at earlier stages of the disease and survival improves after cancer treatment, hand therapy may improve the functional outcomes of persons with cancer. This judgment of rehabilitation oncology practice will need to be confirmed by research.

References


