Hemiplegia/Hemiparesis in Stroke and Brain Injury

Hemiplegia in Cerebral Palsy is discussed under Developmental Disorders—Cerebral Palsy—Spastic Hemiplegia Type.

Description

Hemiplegia is defined as paralysis on one side of the body caused by brain damage, while *hemiparesis* is weakness or partial paralysis on one side of the body caused by brain damage, usually opposite the site of the cerebral vascular accident (CVA) or other brain injury (Woodsen, 2008, p. 1002). Certain impairments are associated with lesions in a particular hemisphere. For example, left CVA may cause right hemiparesis, aphasia or other communication deficits, and/or apraxia or motor planning deficits. Right CVA may result in left hemiparesis, visual field deficits or spatial neglect, poor insight and judgment, and/or impulsive behavior.

This chapter focuses on articles that discuss topics in relation to hemiplegia or hemiparesis. The topics most discussed are grip or grasp strength and force, reaching, shoulder pain, and bilateral movement. Other topics discussed include biofeedback, botulinum toxin A, constraint-induced movement therapy, contractures, fine-motor control, functional electrical stimulation, haptic training, neuroprosthesis training, physical fitness, postural stabilization, virtual reality, weight bearing, and wheelchair use.

Cause

Primary cause is a stroke, although a traumatic injury or brain tumor may also cause hemiplegia/hemiparesis.

Assessment

Areas

- Activities of Daily Living/Instrumental ADL: self-care, meal preparation, shopping, driving
- Education/Work: education or work tasks
- Play/Leisure: leisure interests and activities
- Social Participation: life roles and role performance
- Sensorimotor: bilateral coordination and dexterity, grip and pinch strength, hand function, joint range of motion, pain (especially in the shoulder), transfers
- Cognitive: perception (especially visual)
- Psychosocial: depression, anxiety, frustration, social support
- Context/Environment: home and community safety, home modification, assistive devices

Instruments Developed by Occupational Therapy Personnel

- *Box and Block Test.* Desrosiers, J., Bravo, G., Hébert, R., Dutil, E., & Mercier, L. (1994). Validation of the Box and Block Test as a measure of dexterity of elderly people: Reliability, validity, and norms studies. *Archives of Physical Medicine and Rehabilitation, 74,* 751–757.
- *Canadian Occupational Performance Measure, 4th ed.* (COPM). Law, M., Baptiste, S., Carswell, A., McColl, M. A., Polatajko, H., & Pollock. N. (2004). Toronto, Ontario: Canadian Association of Occupational Therapists.
- *Lowenstein Occupational Therapy Cognitive Assessment* (LOTCA). Itzkovich, M., Elazar, B., & Averbuch, S. (1993). Pequannock, NJ: Maddak.
- *Reaching Performance Scale.* Levin, M. F., Desrosiers, J., Beauchemin, D., Bergeron, N., & Rochette, A. (2004). Development and validation of a scale for rating motor compensations used for reaching patients with hemiplegia: The Reaching Performance Scale. *Physical Therapy, 84*(1), 18–22.
- *Upper Extremity Performance Test for the Elderly* (TEMPA). Desrosiers, J., Hébert, R., Dutil, E., & Bravo, G. (1993). Development and reliability of an upper extremity function test for the elderly: The TEMPA. *Canadian Journal of Occupational Therapy, 60,* 9–16.

Instruments Developed by Other Professionals and Used by Occupational Therapy Personnel

- *Action Research Arm Test.* Lyle, R. C. (1981). A performance test for assessment of upper limb function in physical rehabilitation treatment and research. *International Journal of Rehabilitation Research, 4,* 483–492.
- *Arm Motor Ability Test* (AMAT). Kopp, B., Kunkel, A., Flor, H., Platz, T., Rose, U., Mauritz, K., . . . Taub, E. (1997). The Arm Motor Ability Test: Reliability, validity, and sensitivity to change of an instrument for assessing disabilities in activities of daily living. *Archives of Physical Medicine and Rehabilitation, 78,* 615–620.
- *Ashworth Scale, Modified.* Bohannon, R. W., & Smith, M. B. (1987). Interrater reliability of a modified Ashworth Scale of muscle spasticity. *Physical Therapy, 67,* 206–207.
- *Barthel Index* (BI). Mahoney, R., & Barthel, D. (1965). Functional evaluation: The Barthel Index. *Maryland State Medical Journal, 14,* 612–615.
- *Chedoke-McMaster Stroke Assessment* (CMSA). Gowland, C., Stratford, P., Ward, M., Moreland, J., Torresin, W., Van Hullenaar, S., . . . Plews, N. (1993). Measuring physical impairment and disability with the Chedoke-McMaster Stroke Assessment. *Stroke, 24,* 58–63.
- *Fugl-Meyer Assessment.* Fugl-Meyer, A., Jääkö, L., Leyman, I., Olsson, I., & Steglind, S. (1975). The post-stroke hemiplegic patient. Part I. A method for evaluation of physical performance. *Scandinavian Journal of Rehabilitation Medicine, 7,* 13–31.
- *Functional Independence Measure* (FIM). Uniform Data System for Medical Rehabilitation. (1997). *Guide for the uniform data set for medical rehabilitation (including the FIM™ instrument), Version 5.1.* Buffalo, NY: State University of New York at Buffalo.
- Grip Strength/Force. Mathiowetz, V., Weber, K., Volland, G., & Kashman, N. (1984). Reliability and validity of grip and pinch strength evaluation. *Journal of Hand Surgery (Am), 9,* 222–226.
- *Jebsen Taylor Hand Function Test.* Jebsen, R. H., & Taylor, N. (1969). An objective and standardized test of hand function. *Archives of Physical Medicine and Rehabilitation, 50,* 311–319.
- *Mackinnon-Dellon Disk-Criminator.* Dellon, A. L., Mackinon, S. E., & Crosby, P. M. (1987). Reliability of two-joint discrimination measurements. *Journal of Hand Surgery, 12,* 693–696.
- *Minnesota Manual Dexterity Test* (MMDT). Lafayette Instrument. (1991). Lafayette, IN: Author.
- *Motor Activity Log.* Uswatte, G., & Taub, E. (1999). Constraint-induced movement therapy: New approaches to outcome measurement in rehabilitation. In D. T. Stuss, G. Winocur, & I. H. Robertson (Eds.), *Cognitive rehabilitation: A comprehensive approach* (pp. 215–229). Cambridge, UK: Cambridge University Press.
- *Motor-Free Visual Perception Test, 3rd ed.* (MVPT-3). Colarusso, R. P., & Hammill, D. D. (2002). Novato, CA: Academic Therapy.
- *Semmes-Weinstein Monofilament Test.* Bell-Krotoski, J. A. (1990). Light touch-deep pressure testing using Semmes-Weinstein microfilaments. In J. M. Hunter, L. H. Schneider, E. Mackin, & A. D. Callahan (Eds.), *Rehabilitation of the hand: Surgery and therapy* (2nd ed., pp. 585–593). St. Louis, MO: Mosby.
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- *Sustained Grip Strength Test* (SGST). Original articles in Japanese. Kamimura, T., & Ikuta, Y. (2002). Evaluation of sustained grip strength for a stroke patient with a mild paresis. *Hiroshima Journal of Medical Sciences, 51*(1), 23–31.
- *Visual Analogue Scales.* Huskisson, E. C. (1983). Visual analogue scales. In R. Melzack (Ed.), *Pain measurement and assessment* (pp. 305–311). New York, NY: Raven Press.
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Problems

Activities of Daily Living/Instrumental ADL

- Person may have difficulty performing ADLs that typically are performed by both hands (bilaterally), such as cutting food, grooming, toileting, bathing, and dressing.
- Person may have difficulty performing ADL tasks that are typically performed by the dominant hand and arm if that side of the body is involved, such as eating, brushing teeth, and combing hair.
- Person may have difficulty performing IADLs that are typically performed by both hands and arms, such as meal preparation, laundry, cleaning, opening mail, driving, pushing a shopping cart, and paying for purchases with cash or credit/debit card.
- Person may have difficulty performing IADLs that are typically performed by the dominant hand if that hand is involved, such as writing, using a key to open a door, and pushing buttons on a remote.

Education/Work

- Person may have difficulty performing work-related activities that are typically performed bilaterally, such as keyboarding.
- Person may have difficulty performing work-related activities that are typically performed by one hand, such as holding or dialing the phone.

Play/Leisure

- Person may have difficulty performing leisure activities that are typically performed bilaterally, such as playing card games, playing golf, knitting, and embroidering.
- Person may have difficulty performing leisure activities that are typically performed using one hand, such as throwing darts and doing crossword puzzles.

Social Participation

- Person may have difficulty participating in activities he/she formerly enjoyed due to changes in sensorimotor, cognitive, or psychosocial capacities.

Sensorimotor

- Person may lose, or experience decreased use of, one side of the body or one upper extremity.
- Person may experience shoulder pain during shoulder movement in flexion and abduction due to subluxation, abnormal muscle tone, limitations in shoulder range of motion, capsular contractures, adhesive capsulitis, rotator cuff ear, brachial plexus injury, shoulder–hand syndrome, or pre-existing conditions.
- Person's scapula may pull into retraction and downward rotation, with internal rotation and adduction of the arm and elbow flexion, and with minimal or no movement at the wrist and fingers.

Cognitive

- Person may lose or experience decreased use of cognitive skills, such as attention, learning, memory, and executive functioning.

Psychosocial

- Person may experience depression, anxiety, or loss of interest.

Treatment/Intervention*

Treatment models include remedial approaches, such as biomechanical and neurodevelopment treatment (NDT), and compensatory approaches. Team members may include a physician (internal medicine, psychiatry), nursing personnel, a physical therapist, and occupational therapy personnel. Occupational therapy focuses on increasing awareness of the involved side; helping

the person learn to integrate or incorporate the weaker side into activities along with the stronger side; and preparing for function by improving trunk control, weight shift, and proximal stability (Davis, 2001).

Activities of Daily Living/Instrumental ADL (Edmans et al., 2001)

- Bathing/showering
  - Have client use liquid-soap dispenser, use a soap-on-a-rope to hang around neck, or put soap in a pocket washcloth.
  - Have client use bath/shower bench to help him/her get into shower or bath, to sit on, and to help him/her get out again.
  - Have client use grab rails.
  - Have client place nonslip mat in tub or shower.
  - Have client use showerhead or jug.
  - Have client wring out washcloth by wrapping it around the faucet/top and twisting ends together.
  - Have client use a long-handled brush to wash back and feet.
  - For drying, sew a loop onto one end of towel and attach to a hook to fix one end. Client can pull taut across back or put on a terry cloth robe.
- Dressing
  - Show client to lay upper-body garment (shirt, blouse, cardigan, sweater) on knees with backside up, neck furthest from body.
  - Have client start by putting the garment on the affected arm first and pulling sleeve past elbow. Then have him/her put unaffected arm in other sleeve, pull over his/her head, pull down bottom of garment, and adjust.
  - To remove upper garments, have person gather garment from back of neck and pull it over his/her head, pulling out unaffected arm, and finally removing garment from affected arm.
  - For lower-body garment (pants, trousers, slacks, jeans, socks, shoes), have person cross the affected leg over the sound leg and lean forward to put garment over affected foot. Client then uncrosses legs and reaches down to put garment over the sound foot. In sitting position, client pulls pants over knees, stands up, and continues pulling up. If balance is a problem, have person stand against a wall or corner for additional support.
  - Client may use zipper pull ring or hook to zip.
  - Socks: Have client open aperture with span of unaffected hand, reach down and place sock over toes, and work it over the foot.
  - Shoes: The best approach is to get loafers that do not have to be tied. Alternatively, get shoes with Velcro fasteners. Elastic shoelaces can be used, which remain tied. Instructions for one-handed tying are available.
- Eating: Client may use cutlery with built-up handles for easier grasp. A rocker knife, plate guard, buttering board, and nonslip mat under plate can be helpful.
- Grooming/hygiene
  - Shaving: Have client use electric razor.
  - Cleaning/clipping nails: Have client use suction nail brush or file, or a nail clipper.
  - Dentures: Have client soak dentures overnight or use a suction nail brush.
- Toothbrushing
  - To open toothpaste tube, client may wedge tube between knees or teeth or against a solid object, and unscrew top with uninvolved hand.
  - Have client put toothbrush on a hard surface with bristles pointing up and put toothpaste on bristles.
  - Have client hold toothbrush handle in mouth and put toothpaste on bristles.
- Meal preparation
  - Stabilizing: Person may stabilize an object using a nonslip mat, pan holder, spike board, buttering board, or clamp, or he/she may wedge object against solid, fixed surface. A damp cloth also works as a nonslip mat.
  - Cutting: Have person use spiked chopping board, food processor, or ergonomic knives (handle at right angle to cutting blade).

  - Opening containers: Have person use electric can openers or mounted can or jar openers, or have him/her wedge container between knees.
  - Carrying: Have person use a cart or trolley, or a one-handed tray.
- Cleaning and laundry
  - Long-handled tools may be used to facilitate ease of reach.
  - Client may pick up items from floor using a reacher. If item is magnetic, a stick with a magnet on the end will retrieve the item.
  - Have client put cleaning supplies on a cart or trolley to move them about or put on a handyman garment and place items in pockets.
- Communication
  - Writing: Person may use a paperweight or other heavy object to hold paper, or place it in a spring-loaded clipboard.
  - Telephone: Have person use a phone that can be held in one hand.
  - Keyboarding: One-handed typing instructions may be used.
- Mobility: Have client consider use of a scooter or walking aid for going distances.

Play/Leisure

- Sewing: Have person put needle into pincushion to hold it while threading or buy a block needle threader.
- Playing cards: Have person use a tray with a back to hold cards or use two disks with elastic between.

Sensorimotor

- Active and active-assistive range-of-motion exercises should be started to maintain range of motion, as long as the exercises do not cause fatigue.
- Bilateral use: Encourage use of both hands at the same time to help the person improve awareness of the involved side and better integrate both sides of the body. Examples: shaving, wiping a table, and washing a window.
- Constraint-induced movement therapy: Functional limb is restrained during waking hours, except during specific activities, and client is forced to do tasks primarily with affected extremity.
- Graded activities: Start with easy activities, such as eating. Use more difficult activities as the person improves.
- Guided movement: Therapist places a hand over the person's hand to help him/her correctly manipulate objects during a task.
  - Place hand completely over the person's hand down to fingertips, if possible.
  - Try to move with the person in as normal a movement pattern as possible.
  - Keep talking to a minimum and allow feedback to come from the activity.
  - Stand or sit so that your movements are similar to the person's.
  - Be sensitive to person's movements and move together in a normal sequence.
  - Guide both of person's hands when possible, not just the involved hand (Davis, 2001, p. 10).
- Meaning and purpose: Choose activities that have meaning and purpose to the person to encourage participation.
- Modification: Modify the *activity* to elicit better movement, or modify the *position* of the person to elicit more appropriate movement, as well as modifying the person's *movement*.
- Positioning: Affected upper extremity should be positioned in shoulder protraction, while arm is brought forward, spine aligned, and finger extended (Gilmore, Spaulding, & Vandervoort, 2004, p. 42). When sitting, both feet should be flat on the floor and both arms supported on a table or on armrests.
- Robotic therapy: Use to provide intensive repetition of the therapeutic movement, guide an affected extremity in executing the movement, provide feedback (such as to a computer screen), and measure progress.
- Skills: Use activities appropriate to the person's skill level. More complex activities require more skill.

- Stretching: Stretching as exercise does not reduce hemiplegic pain or maintain shoulder range of motion (Gustafsson & McKenna, 2006). Stretching incorporated into a functional activity should be encouraged.
- Stabilization/weight bearing: Facilitate use of involved arm on a table or other surface within the visual field by having person hold or stabilize an object during a bimanual activity.

Cognitive

- Awareness: Position bed so person's weak side is toward the door, TV, or nightstand. This position encourages staff, family, and others to approach from the weak side, improving awareness of that side. In addition, have person reach for water and phone toward the involved side. Objectives are to decrease hemineglect and compensate for visual field loss (Davis, 2001).

Psychosocial

- Frustration: Use grading or adapted techniques (cues or prompts) to facilitate task performance. Focus on obtaining success.

Context/Environment

- Assistive devices
  - Combined tools: Have client use spork (combined spoon and fork), or combined spoon and fork plus rocker knife.
  - Enlarged handles: Enlarged handles decrease the need for hand grasp.
  - Ergonomic design: Use joints at best position, such as right-angle cutting knife.
  - Extended or elongated handles: Long handles increase length of reach and increase torque for turning items such as faucets or knobs.
  - One-handed modifications: These modifications permit activity to be performed with one hand.
  - Strap handles/U-shaped handles: Handles decrease the need for grasping.

Precautions

- Person may have problems with balance that increase the risk of falling.

Prognosis and Outcome

- Resistive exercise for hemiplegic extremities may increase spasticity, and thus is controversial (Porter, 2011, p. 3463).
- Slings: Evidence for use of slings as effective for reducing shoulder pain and subluxation is limited. Negative results may occur in range-of-shoulder movement and flexor tone. A sling should be recommended only for flaccid upper extremities for the purpose of protection when the person is walking (Aoyagi & Tsubahara, 2004).
- Splints: There is insufficient evidence as to the effectiveness of splints in decreasing spasticity in persons who have a stroke and no long-term follow-up (Aoyagi & Tsubahara, 2004).
- Therapeutic electrical stimulation: TES for the purpose of inducing exercise has been demonstrated to be effective when applied to supraspinatus and posterior deltoid. Short-term improvement in subluxation, pain, arm function, and range of motion has been documented, but there is no agreement on long-term benefits (Aoyagi & Tsubahara, 2004).

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