BRAIN INJURY 101

A BASIC GUIDE FOR THE INDIVIDUAL AND FAMILY

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The Brain

Acquired Brain Injury (ABI) is an injury to the brain that is not hereditary, present at birth, or degenerative. Causes include traumatic brain injury; anoxic/hypoxic injury (e.g. heart attack, carbon monoxide poisoning), intracranial surgery, seizure disorders and toxic exposure (e.g. substance abuse, ingestion or inhalation of volatile agents).

Traumatic Brain Injury (TBI) with or without skull fracture is an insult to the brain caused by an external physical force that may produce a diminished or altered state of consciousness.

Brain injury may result in an impairment of cognitive abilities (e.g. perception, memory, or judgment), physical, behavioral or emotional functioning. A brain injury may be either temporary or permanent and may cause either partial or total functional impairment.

Mild brain injury, also known as concussion is an injury that may leave the person feeling dazed or cause a brief loss of consciousness.

Mild brain injury can lead to "post-concussion syndrome" that can include headaches, dizziness, mild mental slowing, and fatigue. For some people, symptoms may last only a few months; for others, problems may persist indefinitely.

Whatever the cause, a brain injury can, according to the Brain Injury Association of America, result in “an impairment of cognitive abilities or physical functioning. It can also result in the disturbance of behavioral or emotional functioning.” Just as each individual is unique, so is each brain injury. Physical disabilities, impaired learning and personality changes are common.

Frequently reported problems include:
Physical - Speech, Hearing, Paralysis, Headaches, Vision, Seizure Disorder, Muscle Spasticity, Reduced Endurance. Physical consequences can include seizures, muscle spasticity, fatigue, headaches, balance problems, among others.
Cognitive Impairments - Concentration, Attention, Perceptions, Planning, Communication, Writing Skills, Short Term Memory, Long Term Memory, Judgment, sequencing, Reading Skills, Orientation. Cognitive consequences can include memory loss, slowed ability to process information, trouble concentrating, organizational problems, poor judgment, difficulty initiating activities, among others.
Behavioral / Emotional Changes - Fatigue, Anxiety, Low Self-Esteem, Restlessness, Agitation, Mood Swings, Excessive Emotions, Depression, Sexual Dysfunction, Lack of Motivation, and Inability to Cope. Emotional/behavioral consequences can include depression, mood swings, anxiety, impulsivity, agitation, among others.

Brain injury affects not only the individual, but the family, close friends, coworkers and other social networks of the individual as well. Roles and relationships change; the financial ramifications may be extensive.

Overview of the Brain

The brain controls all functions of the body, including walking, talking, and eating. It also controls involuntary functions such as breathing, circulation, and using the senses (sight, smell, touch, etc). It allows us to use more complex higher-level functions such as thinking, learning, reading, and remembering. The brain is the size of a grapefruit that sits within the skull. It weighs about three pounds.

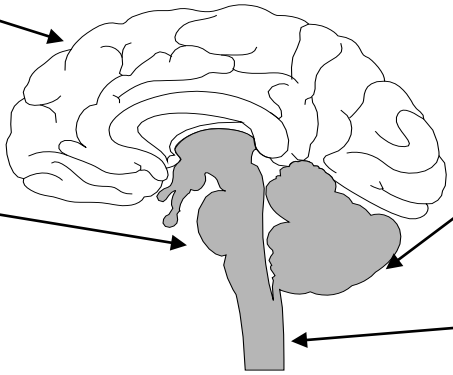
The 3 regions: The brain has 3 main regions – the **cerebellum, brain stem,** and **2 cerebrum hemispheres.** All three regions work together as an integrated unit, yet each region has specific functions. Most brain injuries affect several areas of the brain.

Cerebrum

- Largest part of brain
- Has 4 lobes
- Has 2 hemispheres (left and right)

Brain Stem

- Breathing
- Heart rate
- Arousal/consciousness
- Sleep/wake functions
- Attention/concentration



Cerebellum

- Balance
- Coordination
- Skilled motor activity

Spinal cord

Brain Stem: The brain stem has 2 main functions – basic life functions (respiratory and cardiac) and arousal (alertness to the thinking part of the brain). It sits at the base of the brain, and is an extension from the spinal cord. The brain stem is about the size of your little finger. The 12 cranial nerves originate from the brain stem. Damage to this area could cause reduced arousal and alertness, impairment in breathing, heart rate, and sensation of touch.

Cerebellum: The cerebellum has 2 main functions – balance of the body and coordination of the body movements. It lies under the lower back of the skull, has a right and a left side, and is about the size of two large plums. Damage to this area could cause difficulties in coordination (called ataxia) and difficulties with balance (for walking and standing).

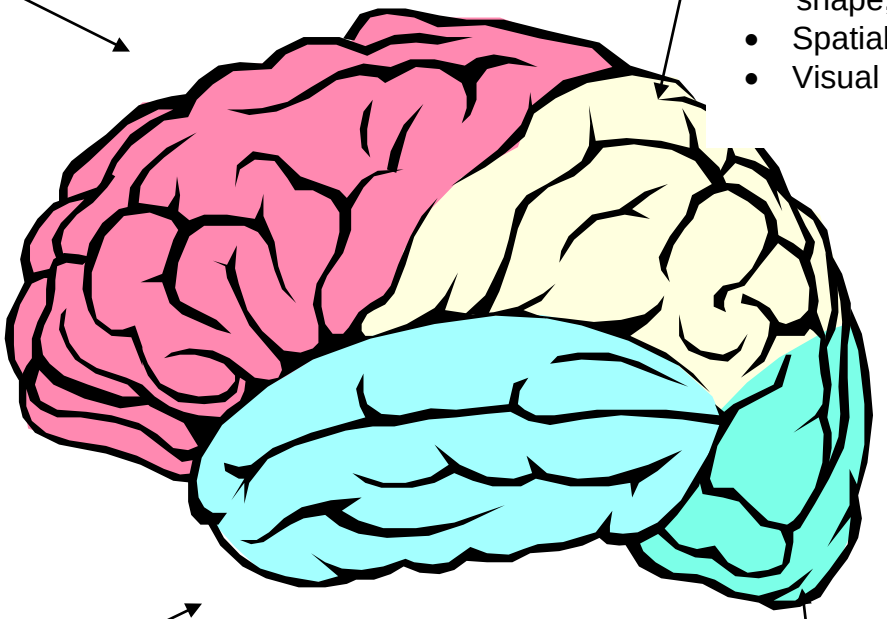
Cerebrum: The cerebrum is the largest part of the brain and has two hemispheres – left and right. The left hemisphere generally controls movement and receives messages from the right side of the body; and the right hemisphere controls movement and receives messages from the left. The dominant hemisphere, which is usually on the left (for right handed people), controls speech, comprehension, reading, writing, arithmetic, and other language functions. The non-dominant hemisphere controls more abstract functions such as orientation, memory, problem solving, and spatial perception.

The cerebrum hemispheres are further developed into four lobes – parietal, frontal, temporal, occipital. See the picture on the next page for explanation of the lobes.

Brain – Behavior Connections

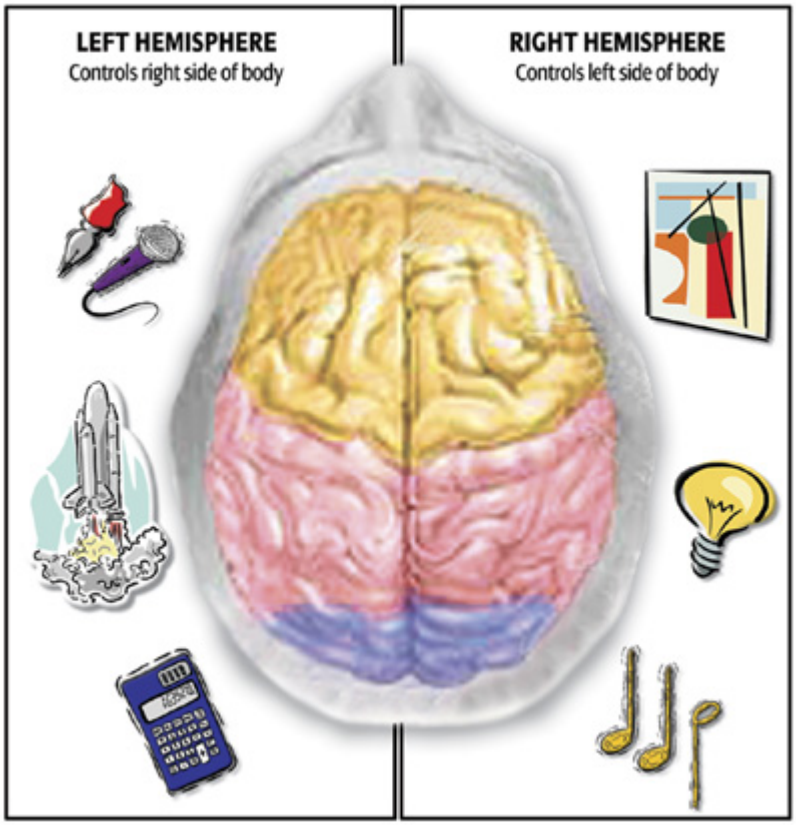
Frontal Lobe
- Initiation
- Problem-solving
- Judgment
- Impulsivity
- Planning
- Self-monitoring
- Motor planning
- Personality/emotions
- Awareness of abilities and limitations
- Organization
- Attention
- Concentration
- Mental flexibility
- Speaking skills

Parietal Lobe
- Sense of touch
- Differentiation of size, shape, color
- Spatial perception
- Visual perception



Temporal Lobe
- Memory
- Hearing
- Understanding language (receptive language)
- Organization and sequencing

Occipital Lobe
- Vision



Left side of brain
Difficulties in understanding language (receptive language)
Difficulties in speaking or verbal output (expressive language)
Catastrophic reactions (anxiety, depression)
Verbal memory deficits
Decreased control over right-sided movements
Impaired logic
Sequencing difficulties

Right side of brain
Impairments in visual-spatial perception
Left-neglect, or inattention to the left side of the body
Decreased awareness of deficits
Altered creativity and music perception
Loss of the “gestalt” or the “big picture”
Visual memory deficits
Decreased control over left-sided movements

Diffuse injury
Reduced thinking speed
Increased confusion
Reduced attention and concentration
Increase fatigue
Impaired cognitive functions across lobes

Possible Consequences of Sustaining a Brain Injury

Physical changes:

- Seizures
- Muscle spasticity or tremors
- Double vision or low vision, even blindness
- Loss of smell or taste
- Speech impairments such as slow or slurred speech
- Headaches or migraines
- Fatigue, increased need for sleep
- Balance problems
- Motor coordination

Thinking changes:

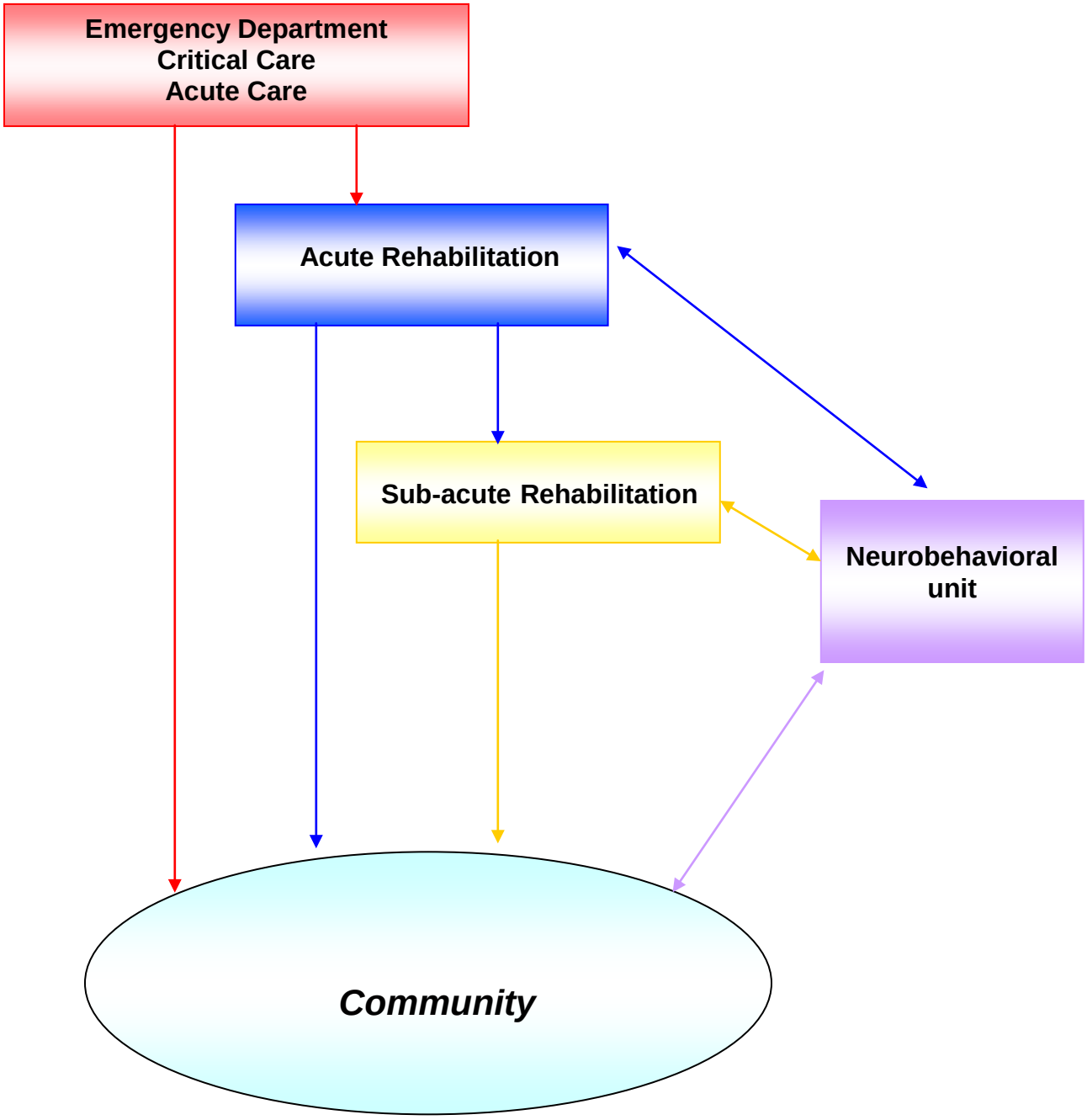
- Short-term memory loss; long-term memory loss
- Slowed ability to process information
- Trouble concentrating or paying attention for periods of time
- Difficulty keeping up with a conversation; other communication difficulties such as word finding problems
- Spatial disorientation
- Organizational problems & impaired judgment
- Unable to do more than one thing at a time
- A lack of initiating activities, or once started, difficulty in completing tasks without reminders
- Decision making difficulties
- Sequencing difficulties
- Inflexibility
- Self-perception
- Persistence

Personality and behavioral changes:

- Depression
- Social skills problems
- Mood swings
- Inappropriate behavior
- Inability to inhibit remarks
- Problems with emotional control
- Difficulty . . .
  - relating to family, friends and others
  - developing and maintaining new relationships
  - identifying and interpreting social cues
- Stress, anxiety, frustration

Continuum of Care Map

A continuum of care map is included below so that one can visualize the process of rehabilitation. It is important to note that the rehabilitation process varies for each individual who has sustained a brain injury.



The Brain Injury Rehabilitation Team

The individual will receive therapies and services from rehabilitation professionals who have expertise in brain injury rehabilitation. The rehabilitation team plays an important role in developing a plan of care and treatment goals and objectives. The individual and his family plan an important role on this team. There are a variety of rehab team members. Some may be more involved initially while some may play a consistent role throughout the rehab process, and yet some may play an important role in the later stages of rehabilitation. Rehabilitation team members may also be identified due to the person's age and nature of the injury.

Neurosurgeon – the medical specialist who performs surgery on the brain and has expertise in structural diseases of the central nervous system.

Neurologist – a medical specialist in disorders of the nervous system. May be involved in the initial diagnosis of brain injury and may continue to monitor recovery.

Neuropsychiatrist – a medical specialist who concentrates on behaviors, personality change, mood changes, memory change, and sleep/wake cycles related to brain injury. The doctor may diagnosis, monitor, and prescribe medications.

Neuropsychologist – a psychologist who specializes in brain-behavior relationships. Administers a series of tests to evaluate person's cognitive, emotional, intellectual, academic/ vocational skills.

Occupational Therapist – helps the individual regain the physical, perceptual, and cognitive skills required to perform Activities of Daily Living (ADLs).

Physiatrist – a physician specializing in physical medicine and rehabilitation. In hospitals and rehabilitation settings, the doctor often eads the rehabilitation team and coordinates the goals into a unified approach.

Physical Therapist – focuses on individual's motor functioning and mobility.

Rehabilitation Nurse – responsibilities vary depending upon the stage of recovery. The nurse closely monitors, coordinates and delivers nursing interventions. Active member of team; and involved in planning, implementing, and evaluating the individual's plan of care.

Social Worker/ Case Manager – role varies in different settings. Acts as a link between the individual, the family, and the team members. May provide education, resources, emotional support, discharge options. May negotiate between facility and financial source.

Speech-Language Pathologist – responsible for evaluating and treating disorders in communication, swallowing, and higher-level reasoning and problem solving.

Vocational Rehabilitation Counselor – evaluates the individual's past vocational or educational performance and current vocational skills. The goal is to help an individual resume appropriate and realistic employment.

Tips for the Family When Working with the Rehabilitation Team

- Learn the team members' roles and the part they play in the rehabilitation of the patient with TBI.
- Trust the different team members and allow them to work with the patient.
- Ask questions and discuss the patient's care.
- Talk openly about your concerns -- it can reduce your frustration.
- To make sure that you remember your question and its answer, write down your question and its answer.
- Ask what can be done to help the patient when the nurse or therapist is not present.

Practical Tips for the Hospital

- Make one or two immediate family members a liaison to family and friends. When information is passed on from the medical staff, have only those people ask questions and relay the message to the other family members.
- Arrange visits with no more than two visitors at any one time. Too many visitors or too many visits can be overstimulating to the patient who has sustained a brain injury.
- Schedule brief visits (15-20 minutes) so that the patient can rest. Rest is an important part of the healing process.
- During visits, only one person should speak at a time. The use of radio and television should be limited during visits.

Things the Family Should be Mindful of (during Rehab and upon Return to Home)

- Reinforce the behaviors you would like to see increase.
- When safety is not an issue, ignore the behavior you would like to decrease.
- Model the behaviors you would like to see the individual display.
- Avoid situations that provoke behaviors you are trying to reduce.
- Structure the environment and setting.
- Use cues for positive behaviors.
- Schedule regular rest periods.
- Redirect the person rather than challenging them.
- Provide 2 choices to the person that are acceptable to you regardless of what is chosen.
- Seek professional help sooner than later.
- Educate yourself. Take time to read articles, attend support groups, and study resources

Changes in Thinking

Some individuals with brain injury may seem to do very well physically, and have the ability to communicate information. He/She may seem "normal". However, he/she may have severe difficulty with memory, problem solving, concentration, and structuring his/her day. Such individuals may need a supervised setting or another person to help structure their day-to-day living.

Common changes in thinking after a brain injury may include:

- Lack of awareness of one's deficits (anosognosia)
- Confusion about time, where one is and who one is (disoriented to time, place and person)
- Distractibility
- Inability to recall or store recent information (recent memory)
- Difficulty recalling the past, prior to the injury (remote memory)
- Difficulty paying attention
- Inability to learn new information
- Difficulty planning, organizing and making decisions
- Difficulty with basic calculations
- Difficulty doing things in correct order (sequencing)
- Impaired ability evaluating what is important or significant
- Relating stories/information/events believed to be true which have not occurred (confabulation)
- Difficulty understanding the abstract (only able to take things literally)
- Difficulty in stopping a task once started (perseveration)
- Difficulty in understanding cause and effect
- Visual motor and visual-spatial difficulties
- Lack of initiation
- Impaired safety awareness

Cognitive impairments often impact the skills required to do normal daily activities, such as attending to personal hygiene, dressing, eating, working, homemaking, learning, and managing finances. Typically, the individual who has experienced a moderate to severe brain injury initially requires at least some degree of supervision, guidance, and direction, in order to initiate, follow through, and complete tasks.

Memory problems are considered by many to be one of the most enduring and disabling consequence of brain injury. Memory for both recent and past information may be affected. Memory loss makes it difficult for the individual to adjust to and compensate for other problems. Memory difficulties may significantly impact an individual's ability to live safely in an independent living setting.

Executive functioning refers to the ability to plan, initiate, direct, and monitor one's activities. It can be likened to what an "executive" does in a business to keep the business running smoothly: organizing, planning, creating, evaluating, and, perhaps most important, initiating. This is also what each one of us does on a daily basis in our jobs and day-to-day activities. Executive functioning really defines us in terms of our human existence. Our ability to engage in meaningful tasks, evaluate what we are able to do, and to congratulate ourselves on what we have accomplished is part of being able to understand ourselves.

With impaired executive functioning, an individual with a brain injury may not respond to the environment as we might otherwise expect. For example, should the individual encounter some problem on the job or at home, he/she may react by yelling or throwing something, interpret the problem inaccurately or "concretely," exhibit poor judgment in arriving at possible solutions, or simply fail to recognize that a problem exists.

The individual with a brain injury often has limited **insight**. He/She may be unable to see his/her cognitive, emotional, or behavioral difficulties, and may have limited awareness of the impact on critical aspects of day-to-day functioning.

Difficulties in **initiation** may result in the individual not spontaneously engaging in meaningful activity, unless prompted. The individual may not pursue relationships, begin to work, or perform simple hygiene. The lack of initiation appears to be one of the most prevalent disabilities occurring as a result of brain injury, and may erroneously be labeled as laziness, faking, or malingering.

The individual with a brain injury may take things at literal face value, only looking at the surface appearance of things without understanding what might lie below the surface. Thinking may become "**concrete**" with little or no ability to generalize information from one activity to another. Often, as a result, the individual may not understand the purpose of certain therapeutic exercises and may even resist therapy.

Speech and Language Difficulties

Impaired word-finding ability, disorganized written or spoken communication, and decreased understanding of the written or spoken words are examples of **language difficulties**. Language problems can be receptive (the ability to understand others) or expressive (the ability to express one's self to others). Difficulties with **speech production** may be apparent, where the facial/oral muscles are weak and/or uncoordinated. The individual with a brain injury may be difficult to understand because of slurring of words, halting speech, or a monotone voice that has no stresses or inflections.

Speech and language problems are quite common. They may include:

- Reduced understanding of spoken or written words (receptive aphasia)
- Impaired expression of thoughts and ideas (expressive aphasia)
- Difficulties "retrieving" or finding the words to say or write
- Difficulties reading
- Difficulties writing
- Problem naming things (dysnomia)
- Increased or decreased rate of speech
- Speech that is harsh, slurred, hard to understand (dysarthria)
- Repeating the same phrase/thought (perseveration)
- Use of inappropriate inflection, vulgar/abusive language, inappropriate body language, inability to take turns, inability to "get to the point" (impaired pragmatics)
- Impaired inflection (dysprosodia)

It may be challenging to always comprehend what the individual is communicating. Communication of ideas and feelings may become compromised after brain injury and can be an ongoing problem. It may also be frustrating for the individual with a brain injury, for he/she may have difficulty accurately perceiving and understanding information around him/her.

Behavioral and PsychoSocial Changes

Throughout the rehabilitation process, behavioral changes may be noticed by the family and the rehab team. The individual may become easily frustrated, and have difficulty controlling verbal and physical aggression. The family may notice increased anger and temper outbursts which may be inappropriately directed at others. There may be episodes of withdrawal, isolation, and avoidance of activities. There may be an increase in inappropriate social behaviors.

Some behavioral changes that may be noted after a brain injury include:

- Wide emotional swings
- Sudden verbal outbursts
- Agitated or aggressive episodes
- Increased frustration
- Increased impulsivity
- Destruction of property
- Self-injurious behavior (head banging, picking, biting one's self)
- Hyperactivity and/or Increased physical activity
- Poor sleep pattern or insomnia
- Inappropriate sexual behavior and/or comments
- Lethargy
- Immature and self-centered behavior
- Decreased sensitivity to others
- Hoarding behavior
- Overall difficulties with self-management and self-regulation
- Sad/depressed mood with suicidal or self-destructive thoughts
- Paranoid/suspicious thoughts (delusions)
- Decreased social skills
- Inappropriate social conversation
- Increased anxiety

Sexual behavior is part of a much larger continuum that includes intimacy. Often, the individual with a brain injury may have difficulty in establishing and maintaining an intimate relationship and may only engage in sexual activity. The individual may become self-absorbed, focus on his/ her own needs, and become unable to be a giving partner.

The dramatic changes in the individual's ability to relate to another human being, as well as the loss of the ability to have loving relationships, can have a devastating effect on the individual and his/her partner. To address these issues, individual or couples therapy is often needed, as well as education and structured guidance.

Changes in Sensory and Motor Abilities

Following a brain injury, there may be changes in the individual's sensory and motor abilities. The changes may be noted for a short period or indefinitely. The changes occur based on the type and location of the brain injury. The effects may be limited to one extremity, one side of the body, or may be generalized and affect all muscle groups or senses. Changes that could occur include:

- Variations in weight
- Variations in body temperature
- Variations in appetite
- Too much or too little urination
- Constipation
- Loss of bowel and/or bladder control (incontinence)
- Balance problems
- Coordination problems (ataxia)
- Inability to plan muscle movement (apraxia)
- Paralysis or paresis (weakness) in any or all limbs
- Too much (spasticity) or too little (flaccidity) muscle tone
- Decreased endurance/more easily fatigued
- Choking/swallowing problems with liquids or solids (dysphagia)
- Decreased gag reflex
- Headaches or pain
- Seizures
- Speech production difficulties
- Partial or total loss of vision
- Weakness of eye muscles and double vision (diplopia)
- Blurred vision
- Impaired depth perception
- Involuntary movement (jerking) of the eyes (nystagmus)
- Increased light sensitivity (photophobia)
- Decreased or loss of hearing
- Ringing (tinnitus) in one or both ears
- Increased sound sensitivity (sonophobia)
- Loss or decreased sense of smell (anosmia)
- Perception of smells without a stimulus
- Loss or decreased sense of taste
- Increased sensitivity to touch (tactile defensiveness)
- Impaired/reduced sense of touch
- Episodic and/or continuous pain

Atmosphere/ Environment

It is important for the individual who has sustained a brain injury to have a structured environment and setting. The environment and the structured setting can play an important role in the rehabilitation and recovery process.

- Provide consistent schedule or routine, (same times for morning routine, etc).
- Arrange living quarters for easy access to items used daily (i.e. bed, dresser, closet, bathroom, etc.) Keep items within reach and in a consistent location..
- Make sure living quarters allows for safe and easy mobility.
- Ensure adequate lighting is available. It is important to note that flourescent lighting may be too bright for the individual.
- Display familiar pictures of family, friends, and pets.
- Use objects familiar to the individual.
- Be mindful that too much noice/audio may be overwhelming for the individual.
- Be mindful that the individual may have difficulty concentrating if there is excess noise/activity in the room.
- Go outside and get a breath of fresh air.
- Too many people can be overwhelming.
- Speak with minimal or no background noise. (Hearing other sounds such as water running, the TV or radio, background conversation, airplanes, dog barking, etc. can be very distracting.)
- Speak of familiar names and places; talk of shared interests and experiences.
- Converse when the individual is awake and alert, not tired.
- Encourage communication

Signs that may Indicate the Individual may be Overwhelmed or Over Stimulated

- The level of alertness or concentration/attention may decrease
- The individual appears to suddenly become fatigued.
- The individual appears sleepy or closes his eyes.
- The individual becomes agitated or combative.
- The individual appears to become upset or confused.
- The individual appears to be frightened and attempts to escape the situation.

It is important for the family members to be able to recognize the signs/triggers that the individual is becoming overwhelmed or over stimulated. When those signs are displayed, the family should make efforts to remove the individual from the situation and/or minimize the distractions in the setting/environment. As the individual recovers, he may become increasingly aware of the signs and trigger points that indicate he is is overstimulated / overwhelmed.

Communication Skills

When speaking:

- Communicate in calm, relaxed manner. Avoid talking too loudly or too softly.
- Use age-appropriate conversational tone, and age-appropriate conversation content.
- Talk in close proximity, in the same room.
- Speak slowly. Processing incoming information (understanding) may take time.
- Say one sentence, and then pause. Avoid producing consecutive multiple sentences. If needed, use pauses within sentences.
- Be aware of how much information the person can process. Sometimes a 2-4-word sentence is enough to process at one time.
- Use visual aids (objects, pictures) when speaking.
- Can also write down the message in addition to saying it.
- Emphasize key words, words that carry most meaning.
- Ask simple questions: 'Where is __?' or ask questions requiring yes/no answers.
- Give simple directions: 'Point to __', 'Show me __'.
- Ask open, positive questions: 'Do you want __?' instead of 'Don't you want __?'
- Ask questions providing 1-2 simple choices: 'Would you like __ or __?'
- Use gestures and facial expressions to accompany messages.
- Be mindful of body language during the interaction.
- Use traditional and appropriate greetings to start and end conversations.
- Avoid sarcasm/high level humor, the individual may not be able to detect the change in your tone of voice or understand a higher level of humor.
- Use clear and concrete sentences.

When listening:

- Determine the general topic of conversation; give your undivided attention.
- Pick a quiet place to talk, with minimal background noise.
- Allow time for individual to respond. Responding to a question may take time.
- Allow individual to retrieve word, yet make sure you avoid frustration. Successful communication is very rewarding.
- Establish preferences of the speaker, for example:
  - Would he prefer you to guess what he is saying?
  - Would he prefer you to finish the sentence?
  - Would he prefer you to interpret for visitors/new people?
- Determine the strategies to use if you have a communication breakdown.
  If you cannot understand the individual, try some of the following:
  - Repeat part of the sentence that you understood.
  - Ask him to say it in different way, use alternative words, describe it.
  - Ask him to write the word(s), gesture, and/or point to picture/word/object.
  - Agree on a signal when you don't understand.
  - Tell him which part of conversation that is not understood.
  - Ask him to repeat the misunderstood words.
  - Use back up plan if needed (writing, spelling, gesturing, rephrasing).

If it is determined that the individual communicates better with written communication (expressive and /or receptive skills), then ensure that the proper supplies are available for use. Supplies may include a pen and paper, day planner /notebook, journal. Additionally, the individual may benefit from using a cell phone (text messages), ipad (with communication applications), alphabet board, or other assistive device. The Speech Therapist will be able to assist the family with identification of devices to increase communication skills.

Cognitive and Behavioral Matters

- The individual may use converse off-topic, use language inaccurately, and possibly display increased use of profanity. These responses can be very common for an individual with a brain injury. It is important to not show amusement, anger, or emotion at those times. Give assistance by providing the appropriate words.
- Positively reinforce appropriate behavior and appropriate language.
- If behaviors or words/sentences are consecutively repeated several times, redirect the person to another topic or activity.
- An individual with a brain injury may have trouble controlling his emotions, and may laugh or cry easily. Allow the individual time to regain control of his emotions or become calm by offering a short break or redirect him to a new activity/focus.
- Be aware that the individual's concentration may only be a few minutes. Provide breaks.
- Make orientation cues/information readily available by posting a calendar, schedule, clock and/or other orientation material in a consistent location.

Brain Injury Terms that may be Used by the Rehabilitation Team

Agitation Uncontrolled restlessness, upset or excitement in response to internal or external factors

Arousal The change from a state of sleep to one of being awake

Aspiration: Food or liquid going into the lungs instead of the stomach

Attention: The ability to focus on a given activity

Awareness: Understanding the problems resulting from a brain injury

Cognition: Thinking or mental activity

Confabulation: Making something up that is not true (Note: the individual may believe it to be true

Distractibility: Inability to hold attention on an activity

Dysarthria: Speech that does not sound normal or is hard to understand due to a weakness of the muscles of the lips, mouth or tongue

Dysphagia: Difficulty with chewing or swallowing food or liquid

Impulsiveness: Doing or saying something too quickly, often leading to errors and difficulties

Initiation: The ability to begin an activity

Judgment: The ability to know the dangers of certain activities and to make correct decisions

Memory: Remembering and learning new things. This includes remembering what you do; remembering what others say; and remembering what you see or read.

Organization: The ability to arrange thoughts and make them sound sensible and orderly

Orientation: A sense of what is going on around you. This includes knowing the day, date, month and year; knowing things about yourself; knowing where you are and how to get around; and knowing what happened to you.

Perseveration: Inability to turn the attention from one thought to another

Pragmatics: Behaviors related to communication, such as eye contact, gestures and facial expressions

Problem solving: The ability to recognize when there is a problem and decide the best ways to correct it

Definitions and Glossary of Terms

Traumatic Brain Injury (TBI) - Traumatic brain injury with or without skull fracture is an insult to the brain caused by an external physical force that may produce a diminished or altered state of consciousness. The most common causes of TBI are vehicle crashes, falls, sports injuries, and violence.

Acquired Brain Injury (ABI) - Acquired brain injury is an injury to the brain that is not hereditary, present at birth, or degenerative. Causes include traumatic brain injury; anoxic/hypoxic injury (e.g. heart attack, carbon monoxide poisoning), intracranial surgery, seizure disorders and toxic exposure (e.g. substance abuse, ingestion or inhalation of volatile agents).

Primary Injury – The injury that occurs at the time of the traumatic injury

Secondary Injury – The injury that occurs after the trauma / traumatic injury

Emergency/Critical Care - The initial point of treatment, sometimes intensive medical and pharmacological intervention for prevention of progressive neurological injury and damage.

Acute Care - A hospital-based program with skilled service delivery that optimizes the individual's medical condition. The individual may or may not receive therapies.

Acute Rehabilitation - A hospital-based, highly intensive skilled service delivery, to optimize the person's medical condition and functional status. Focus on development of bowel and bladder control, communication, mobility, basic hygiene, orientation, and learning. The individual usually receives 3 hours or more of therapy per day. Average length of stay is 3 to 5 weeks.

Sub-Acute Rehabilitation - A hospital or skilled nursing facility based services with focus on medical stability and/or complex nursing needs, in addition to receiving rehabilitation similar to acute rehabilitation. The individual usually receives 1 to 3 hours per day during the week. Average length of stay is 2 to 3 months.

Neurobehavioral Unit - A specialized rehabilitation unit for people who may have difficulty managing behaviors and impulsivity. A highly structured environment, usually hospital-based, but also available in some specialized skilled nursing facilities.

Community - A network of different people who regularly come together for common cause or celebration (as defined by Al Condeluci in 2001).

Anoxia – A lack of oxygen to the brain. Cells of the brain need oxygen to stay alive. When blood flow to the brain is reduced or when oxygen in the blood is too low, brain cells are damaged. Anoxic injury can occur from trauma as well as "non-traumatic events" including heart failure, near drowning, electrocution, and other events, which can alter oxygen flow to the brain.

Brain Swelling (Cerebral Edema) - The brain swells after severe trauma, just like any other part of the body. This is also a major cause of damage after brain injury. Severe swelling can cause compression of the brain stem and death. Brain swelling can lead to neuron damage from compression of the cells or from anoxia caused by a disruption of the blood flow and oxygen to the brain.

Coma - a prolonged state of unconsciousness. The person does not respond to external stimuli. There is no speech, the eyes are closed, and the person cannot obey commands.

Encephalitis – Occurs when there is an infection of the brain, most often due to a virus.

Encephalopathy - This general category may include damage to the brain caused by infections (i.e., meningitis, encephalitis), tumors, and metabolic disorders (i.e., chemical change to the brain).

Fluid Restriction – Sometimes drinking fluid may cause the brain to swell, for the brain may absorb the fluid. Ask the primary nurse before giving fluids to the individual.

Hematoma - If the blood vessels in the brain are damaged by the impact inside the skull, they may bleed to create a pool of blood or hematoma. A hematoma can cause brain injury by damaging the neurons it comes in contact with or by squeezing neurons through increased pressure in the brain. The treatment for a hematoma is to surgically drain, if possible.

Hypovolemic Shock - After injury, loss of blood volume may occur. This may further compromise healthy brain tissue.

Hydrocephalus - The flow of cerebrospinal fluid in the ventricles (cavities) of the brain can sometimes be blocked or disrupted after a brain injury. When this happens, the fluid constantly being made in the ventricles can accumulate in the brain, causing increased pressure. This problem is called hydrocephalus and it can be a serious secondary effect of a brain injury. Inserting a needle into the ventricles to draw off the fluid down a tube into the abdominal cavity can treat hydrocephalus. This procedure, called a ventriculoperitoneal shunt, reduces the pressure inside the brain.

Increased Intracranial Pressure (ICP) - Intracranial pressure occurs because of a build up of pressure within the skull. The brain, membranes and cerebrospinal fluid are encased within the bones of the skull. The fluid formed from the swelling or bleeding builds up and causes increased pressure inside the brain, and the increased pressure causes further damage to brain tissue.

Medications – A variety of medications may be used during the individual's recovery process. Medications should not be used as a substitute for appropriate treatment planning and levels of staffing.

Antibiotics – used to prevent and treat infections
Anti-convulsants – used to prevent seizures
Anti-spasticity agents – used to decrease muscle tone
Antidepressants – used to decrease neurovegetative symptoms
Anti-anxiety agents – used to reduce anxiety
Psychostimulants – used to increase alertness

Positioning – Usually the head of the bed is slightly elevated. This is to prevent build up of pressure in the brain. Ask the nurse before you adjust the bed position.

Seizure Disorders - A secondary effect of brain injury can be a seizure disorder, caused by a specific injury that leads to a disruption in the electrical activity of the brain. Seizure disorders can occur at any point after a brain injury (immediately, soon or much later). Seizures are usually treated with anticonvulsant drugs.

Stroke or Cerebral Vascular Accident (CVA) – A Stroke (or CVA) represents a disruption of blood flow (thrombi emboli) in the brain. A stroke may also be caused by aneurysms (weakening of the blood vessels causing a pouch-like effect), arteriovenous malformations (AVM, whereby veins appear to connect to arteries), and intracerebral hemorrhage (bleeding within the brain, often caused by severe hypertension). The severity of a stroke is often "graded" on a scale from 1 (mild, transient) to V (resulting in coma and its associated features).

Surgery Procedures

Craniotomy – The skull is opened to relieve the cause(s) of increased cranial pressure. Causes could include fractured bones, blood clots, swelling.

Burr holes – small opening in the skull to remove blood clots

Bone flap removal – a piece of the skull is removed to relieve pressure caused by swollen brain tissue. The skull section may or may not be returned once the situation is stabilized.

Toxic or Metabolic Injury – Occurs after exposure to unsafe substances, such as lead, or a harmful buildup of the body's own chemicals, as in kidney failure.

Ventricular Drain (Ventriculostomy) – Drains cerebrospinal fluid from the brain.

Brain Injury Tests and Procedures

Blood Flow / Doppler
Ultrasound test used to detect clots (deep venous thrombosis) in blood vessels of the legs. Safe and painless.

Bone Scan
Test to find heterotopic ossification (excess bone growth); involves injection of medicine followed by images obtained by a special camera. Radiation exposure is the same as a spinal x-ray.

CT Scan
Computerized x-ray provides images of the brain; sometimes used for suspected hydrocephalus.

EEG (Electro-Encephalogram)
Records electrical activity of the brain; can help predict risk for seizures. Safe and painless; requires a medical adhesive that may cause discomfort when removed from the hair.

EMG / NCV (Electromyogram & Nerve Conduction Studies)
Records electrical activity of muscles and nerves; used to predict risk for seizures. Safe and painless; requires an adhesive that can cause discomfort when removed from the hair.

Evoked Potential
Assesses ability of nerves to send information from the body to the brain; used to measure visual, hearing and sensory function, most often in minimally responsive patients unable to have a regular physical exam.

Gastric Tube Insertion
Provides nutrition and fluids through a tube; either surgically inserted in the stomach or inserted into the nose and throat and then down into the stomach.

Intrathecal Baclofen Trial
Surgical procedure (done by a neurosurgeon and therapist) delivers medication into the spaces around the spinal cord; sometimes used to treat spasticity.

MRI (Magnetic Resonance Imaging) Scan
Provides detailed brain images using magnetic energy, and not the radiation used in regular x-rays.

Nerve Block / Botulinum Toxin Injections
Used to treat spasticity by blocking nerve-to-muscle pathway and allowing the muscle to relax. Injections can be mildly uncomfortable.

Shunt (Ventriculo-Peritoneal)
Surgical procedure places a drain from ventricles of brain into abdomen to remove excess fluid in hydroencephalus. Patients are watched closely for signs of infection.

Video Swallow Assessment
X-ray measures swallowing ability. A physician and speech pathologist monitor swallowing of different substances to ensure that food is not aspirated (goes into the lungs rather than the stomach).

X-rays
Internal images to view fractures in bones and look at lungs for possible pneumonia. Painless, but involves a small amount of radiation.