The Missouri Greenbook
Living with Brain Injury

A guide for survivors, families and caregivers
Treating a new brain injury

Evaluating a TBI
Patients with traumatic brain injuries often undergo extensive testing to determine the extent and location of the damage. A health care provider performs a physical exam specifically including a complete neurologic exam which assesses functions of the brain such as strength, sensation, speech, vision and level of consciousness.

X-rays, which show only bony structures, are used to look for fractured bones. CT (computerized tomography), also referred to as CAT (computerized axial tomography), scans of the brain show soft tissue and are often taken soon after the injury as a way to identify swelling, bruising and bleeding. Occasionally MRI (magnetic resonance imaging) scans, which also show soft tissue, may be done to look for subtle damage. An MRI scan may be utilized following a period of recovery as it is helpful in detailing the intricate areas of the brain.

After the initial evaluation, a physician may recommend that an ICP (intracranial pressure monitor) be placed. The monitor, which is inserted through a small opening in the skull, allows for continuous monitoring of the pressure in the brain. Treatment decisions are frequently based on the ICP measurements.

Occasionally, it is necessary to measure the electrical activity in the brain with an EEG (electrical encephalograph). Wires are attached to the scalp in several locations and brain waves are monitored to look for abnormal activity.

Treating a TBI
The immediate effects of a traumatic brain injury range from a return to normal function after a few minutes to a coma. In a coma, a patient is unresponsive and unaware of their surroundings. All levels of functioning between these two extremes may be seen.

“Learn what levels of care and types of treatment are needed and investigate available options.”

- Arpie Vermillion, Seneca, Mo.
  Mother of a TBI survivor
The patient may be confused, disoriented, agitated, or frequently repeat questions or phrases.

When the brain injury is localized to a small area the patient may be normal except for the function affected by the area of the brain that is injured, such as problems with speech or weakness on one side of the body. Whether a loss of function will be permanent or not usually cannot be determined at the time of the initial evaluation.

The goal of treating traumatic brain injuries is to prevent further injury by stopping any active bleeding, keeping the pressure in the brain as close to normal as possible, monitoring blood flow to the brain and preventing any other problems from developing in the rest of the body.

Traumatic brain injury patients are usually positioned so that their head is elevated and neck is kept straight. This position helps control the pressure in their brain.

The fluids that the patient receives are carefully monitored and controlled to decrease swelling. Medications are often used to help control the amount of fluid in the brain. Anticonvulsants, or seizure medications, are used to prevent seizures since patients are at higher risk for seizures after a traumatic brain injury. Since movement and stimulation increase the pressure inside the brain, sedatives are used to help control the pressure.

Some patients who are not in a coma may appear to be in a coma while receiving medications for sedation. Either the brain injury or the sedating medication may take away the patient’s ability to breathe adequately so a ventilator, or artificial breathing machine, may be used. Adjustments of the rate and depth of breaths given by the ventilator can also help to control the pressure in the brain.

Patients with traumatic brain injury are at higher risk for infections, especially if they are not fully awake. Antibiotics may be given in an attempt to prevent infections in the brain or elsewhere in the body. During the course of treatment it is not unusual for patients to develop pneumonia, bladder infections or infection in the blood. Patients may require suctioning, which involves the placement of a small tube into the throat or lungs, to keep the air passages clear and decrease the risk of pneumonia.

TBI patients may need various surgical procedures. Placement of either a pressure monitor or a tube to drain cerebral spinal fluid, a ventriculostomy, requires a small opening to be made in the skull. These procedures may be done either in the intensive care unit or in an operating room.

If it is necessary to remove blood, either a small opening called a burr hole or a larger opening called a craniotomy is made in the skull. Usually the bone taken out is put back in place after the blood has been removed. Sometimes when the pressure in the brain is very high, the piece of bone removed for a craniotomy is left out or placed in a pocket under the skin of the abdomen. This allows more room for swelling in the skull.

**Medical equipment**

Various types of equipment may be used in treating TBI patients (Figure 9). That may include:
- **Electrocardiogram (EKG) wires** – Wires placed on the chest to monitor heart rate and rhythm.
- **Endotracheal tube (ET)** – A tube that passes through the patient's nose or mouth into the trachea to help with breathing. The ET tube is usually connected to a ventilator or breathing machine.
- **Intermittent compression boots** – Leg wraps that inflate and deflate to prevent blood clots in the legs.
- **Intravenous catheter (IV)** – A tube placed in a vein so that fluids, nutrition and medicine can be given directly into the bloodstream.
- **Monitor** – An electronic device that constantly tracks various functions including blood pressure, pulse, breathing, and often intracranial pressure.
- **Nasogastric tube (NG)** – A tube that passes through the patient's nose or mouth into the stomach that may be used to pull extra fluids out of the stomach or to put liquid nutrition into the stomach.
- **Urinary catheter (Foley)** – A tube placed in the bladder to allow urine to drain.

If you have any questions about the equipment, ask your physician or any member of your health care team.
The health care team
Many health care providers will be involved in the care of a patient with traumatic brain injury. Usually, a trauma surgeon will initially be in charge of coordinating care and treating injuries to the chest, pelvis or abdomen. A neurosurgeon may be consulted specifically to take care of the injury to the brain and perform any necessary brain surgery. A neurologist may be consulted to treat seizures and any other neurological-based problems.

An intensivist or pulmonologist may help manage problems with breathing, blood pressure or intracranial pressure. Orthopedic surgeons, infectious disease specialists, thoracic surgeons or other specialists may be consulted if the need arises.

A physiatrist, a physician who specializes in physical medicine and rehabilitation (PM&R), may become involved early in the care of the patient to coordinate physical rehabilitation services.

Physical therapists work on motion, strength and coordination. Occupational therapists try to restore the patient’s ability to perform activities of daily living (ADL) such as eating, dressing and grooming.

Physical therapists, occupational therapists, and speech pathologists will become involved as the patient stabilizes and begins to recover. Therapy is aimed at helping the patient regain function or become accustomed to changes in function.

Speech pathologists direct their therapy to improving speech, swallowing and thought processes.

Dietitians will assess the nutritional needs of the patient and determine the best way to meet those needs. In severely injured patients, nutrition may first be given into a vein, progressing eventually to a normal diet of solid food, depending on the level of recovery achieved.

Respiratory therapists monitor breathing, secretions from the lungs and the level of oxygen in the blood. They may give breathing treatments, suction secretions or adjust oxygen levels as needed.

Recovery process
It is often difficult for health care professionals to answer a family’s questions about whether their loved one will recover completely and how long the process will take. Most treating physicians and rehabilitation team members will talk in generalities especially during the first six months, which is a very dynamic period of recovery.

Families and individuals with TBI can find themselves feeling frustrated and concerned when recovery takes longer than expected and the person is changed. This is a typical reaction as the individual and family members are anxious to return to normal life. Many health care providers will be involved in the care of patients with traumatic brain injury.
to previous life activities. The following information provides general information gleaned from research on outcome following TBI:

- The majority of individuals experiencing concussion/mild TBI recover fully within about three months.
- Six out of 10 people with TBI have mild or no permanent significant disability. They may experience mild changes in thinking or emotional adjustment that can interfere with their school, work and/or family life.
- About three out of 10 people with TBI have lifelong moderate disability. They can continue to have productive lives even though they have ongoing problems.
- The recovery process for moderate to severe brain injury typically occurs within the first one to two years after the TBI. However, research suggests that ongoing improvement in compensation and function, to a lesser degree, can occur after two years, and mostly among individuals who continue to work on areas of change.
- The length of stay in an inpatient rehabilitation unit varies with the level of injury although statistics show a typical range from three to 12 weeks.
- The length of care in outpatient rehabilitation is often dependent upon payer limits and may also last for weeks to months at decreasing levels of treatment frequency.
- About one out of every 10 people with TBI has severe disability and needs long-term care.
- Less than one percent (0.6 percent) of individuals with TBI remain in a coma for a long time or rely on machines to live.

Making the most of the hospital stay
Families of patients with traumatic brain injuries are often overwhelmed by the amount of personnel, procedures and equipment required for treatment. It is helpful to keep a journal of events occurring throughout treatment and recovery.

Keeping a list of questions for health care providers can keep communication open and avoid confusion and unnecessary stress. Many families establish a phone tree or use the Internet to transmit important information to family and friends in a way that is less time consuming and burdensome. If the hospital stay and recovery are prolonged, which is common, a rotating schedule of visits will provide respite and comfort to all involved.

“Keep a positive attitude even through your tears. Never lose hope.”

- Debby Beffa, Chesterfield, Mo. 
  Mother of a TBI survivor