Treatment

There are three stages of treatment for TBI:

Acute: to stabilize the patient immediately after the injury;
Subacute: to rehabilitate and return the patient to the community; and
Chronic: to continue rehabilitation and treat the long-term impairments.

Acute Treatment

Initial acute treatment focuses on saving the victim's life. Rescue or emergency personnel unblock airways, assist breathing, and keep blood circulating. **Cardiopulmonary resuscitation** may be as necessary. Treatment then focuses on stabilizing the patient. Hospital personnel then take over, working to maintain the body fluid levels and prevent or treat infections and other complications.

Several types of TBI require **surgery**. Surgery may be performed within hours or days of the injury, if a blood clot causes increased intracranial pressure (ICP). Some clots must be removed; others must not be removed because of the danger of disturbing them. Subdural hematomas and intracerebral hemorrhages may also increase ICP, sometimes necessitating surgery.

During acute treatment, swelling in the brain (edema) is monitored and treated. Brain edema can have dire consequences, causing increased pressure inside the head (intracranial pressure or ICP). Because the skull is hard, ICP can compress or squeeze the soft brain tissue against it, preventing blood from circulating adequately in the brain tissue and causing damage to brain cells. Most edema subsides within a few days or weeks, but a few minutes or hours of excessive ICP can cause permanent damage.

To manage this condition, a device called an **ICP monitor** can be inserted through the skull to provide physicians with a constant pressure reading. If the ICP rises too high, medications are administered to draw fluid out of the brain and into blood vessels, decrease the brain's metabolic requirements, and increase blood flow to the injured tissues. The patient also can be placed on a ventilator to ensure an adequate supply of oxygen (hyperventilation), which is necessary to promote healing. When brain swelling is particularly severe, elevated pressure can only be relieved temporarily by surgically removing a portion of the skull. This allows swollen tissues to bulge out reducing the risk for pressure-induced damage.

A buildup of fluid inside the brain is also a concern in acute treatment. If the fluid-containing spaces in the brain (ventricles) experience blockage, a neurosurgeon must insert a tube called a **shunt** to drain the fluid build up (hydrocephalus). This allows the ventricles to shrink and restores normal function to brain cells. Elevated ICP due to swelling, hydrocephalus, or blood clots significantly impacts recovery from TBI.

Seizures may occur seconds, weeks, or years after TBI. A seizure can be a minor twitching of one finger or limb, or a complete loss of consciousness accompanied by involuntary movements of the entire body. Seizures can be particularly dangerous during this time, so most patients with moderate to severe TBI receive **antiseizure medication** for at least the first few weeks.

Another important aspect of acute care is the **prevention of other medical problems**. One concern is the development of abnormally high or low levels of sodium, calcium, sugar, or other substances in the blood that can worsen confusion and

precipitate seizures. TBI patients also are at high risk for infections, including pneumonia, urinary tract infections, and sinusitis, which must be treated promptly and aggressively.

Subacute Treatment

Subacute treatment is provided after stabilization, which ranges from medical stability to a patient's return to the community or admission to a chronic care facility. The patient is usually admitted to an acute rehabilitation hospital equipped to manage TBI and its complications. At admission, most patients still are in post-traumatic amnesia (PTA).

The main goals of subacute treatment are

- early detection of complications,
- facilitation of neurological and functional recovery, and
- prevention of additional injury.

Early detection of complications

In subacute treatment, facility staff watches for and treat bedsores, muscle contractions, infections, and other complications, such as fluid accumulation in the brain (e.g., hydrocephalus, subdural hygromas), that may require surgical treatment. A neurologist investigates for complications if the patient fails to progress as expected.

Facilitation of neurological and functional recovery

Neurological function often improves incompletely, so rehabilitation professionals – physical, occupational and speech therapists, nurses, neuropsychologists, neurologists, and others specializing in traumatic brain injury – help patients and their families understand neurological impairments. They encourage patients and their families to take advantage of improvements as they occur. Sometimes a patient must learn new ways to do simple routine tasks – such as how to button a shirt or tie a shoe with one hand, or how to compensate for memory loss by using a logbook or calendar.

Prevention of injury

During PTA, many patients experience poor balance, incoordination, weakness, or cognitive impairments that place them at risk for injury. They may be impulsive and unaware of their physical limitations and may try to climb out of bed or walk by themselves when it is unsafe to do so. Agitation and restlessness may also lead to injury. A well-designed rehabilitation unit and well-trained staff can keep them safe, using little or no medication.

In most cases, patients are discharged from the hospital once they emerge from PTA and can demonstrate, along with family and caregivers, that they will be safe in the home.

Disabilities and handicaps

Disability refers to loss of physical and mental function caused by neurological impairment. Examples include the following:

- Decreased ability to interact with others in socially acceptable ways
- Decreased ability or inability to walk
- Inability to carry or manipulate objects
- Inability to feel characteristics of objects
- Inability to process and retain information
- Inability to see clearly
- Poor coordination of fingers or limbs

Handicap refers to the overall disadvantage a person with one or more disabilities may experience. Some examples are:

- Difficulty forming and maintaining personal and professional relationships
- Difficulty participating in civic and social activities
- Difficulty participating in physical recreational activities
- Decreased ability or inability to work for pay and benefits

Note: In some instances sub-acute treatment refers to treatment in a nursing home. Be aware of how the medical care team uses these words and make sure you understand what the team means

Chronic Treatment

Disabilities from TBI may last a lifetime, and different interventions may be appropriate even many years later. This is particularly true for survivors of moderate to severe TBI. It is essential for survivors, their families, and caregivers to be involved in designing and implementing the rehabilitation plan.
There are two categories of chronic treatment:

- Community-based rehabilitation and return to work or school, and
- Treatment of long-term consequences of the injury.

Community-based rehabilitation

Ultimately, rehabilitation must take place in the community rather than the controlled environment of a rehabilitation facility. Some patients do best with individual therapy (speech, occupational, physical) at an outpatient facility or at home. For others, a multidisciplinary, case-managed program works best. Most urban regions in the United States have these programs. This approach utilizes a team of professionals that is usually composed of one or more therapists and social workers, a case manager, and vocational specialist. Case-managed programs are very effective, especially for patients with complex medical and social problems.

Treatment of consequences of TBI

Patients may have residual symptoms that require skilled management by qualified neurologists, physiatrists, and neuropsychologists. Common symptoms and their related treatments include:

- Abnormal muscle tone (e.g., spasticity, dystonia) may be treated with physical therapy, oral medication, and minor surgery.
- Chronic pain sometimes requires medication, physical therapy, and psychological techniques.
- Depression, anxiety, and behavioral problems usually are treated with medication and psychotherapy.
- Seizures and headaches may require medication.

The Glasgow Coma Scale is useful for predicting early outcome from a head injury but it is less useful for estimating how a patient eventually will function in daily, independent living.

Many rehabilitation centers use the Ranchos Los Amigos Scale of Cognitive Functioning to follow the recovery of the head injury survivor and to determine when he/she is ready to begin a structured rehabilitation program. The scale is divided into eight stages, from coma to appropriate behavior and cognitive functioning.

Rancho Los Amigos Levels of Cognitive Functioning

I. No response to stimulation
II. Generalized response to stimulation
III. Localized response to stimulation
IV. Confused, agitated behavior
V. Confused, inappropriate, non-agitated behavior
VI. Confused, appropriate behavior
VII. Automatic, appropriate behavior
VIII. Purposeful, appropriate behavior

This scale does not take into account many changes in the patient's cognitive, memory, and motor functions that suggest whether he or she will be able to return to work or school. Assessments by neuropsychologists, speech pathologists, and therapists are needed.

The amount of **social support** a person receives gradually becomes the most important factor in ensuring the fullest possible recovery. Once the patient plateaus, family, friends, and an experienced treatment team of physicians, therapists, social workers and psychologists must work together to provide critical emotional, physical, medical, and psychological support.

Prognosis

Physicians look at several indicators to predict the level of a patient's recovery during the first few weeks and months after injury:

- Duration of coma
- Severity of coma in the first few hours after the injury (as measured by the Glasgow Coma Score)
- Duration of post-traumatic amnesia (PTA)
- Location and size of contusions and hemorrhages in the brain
- Severity of injuries to other body systems sustained at the time of the TBI

Precise predictions are difficult with TBI, but some generalizations can be made:

- The more severe the injury, the longer the recovery period, and the more impairment a survivor will have once recovery has plateaued.
- Recovery from diffuse axonal injury takes longer than recovery from focal contusions.
- Recovery from TBI with hypoxic injury is less complete than without significant hypoxic injury.
- The need for surgery does not necessarily indicate a worse outcome. For example, a patient requiring the removal of a blood clot may recover as completely as one who never needs surgery.

Cognitive and behavioral processes are controlled by specific areas of the brain, so the location of the injury determines the type of impairment. For example, patients who suffer a diffuse axonal injury and/or a diffuse hypoxic injury often have difficulty with concentration and long-term memory. They may have trouble dealing with more than one thing at a time, difficulty keeping track of appointments, and keeping organized. Those who suffer focal contusions or hemorrhages have problems associated with the particular brain areas affected. For example, a hemorrhage deep in the left side of the brain may cause weakness of the right side of the body. A patient with contusions of the frontal lobes may have trouble being organized or may have behavioral problems such as abnormal passivity, impulsiveness, or aggressiveness.

The length of time a patient spends in a coma correlates to both post-traumatic amnesia (PTA) and recovery times:

- Coma lasting seconds to minutes results in PTA that lasts hours to days; recovery plateau occurs over days to weeks.
- Coma that lasts hours to days results in PTA lasting days to weeks; recovery plateau occurs over months.
- Coma lasting weeks results in PTA that lasts months; recovery plateau occurs over months to years.

Physicians trained in the care of brain-injured patients can best determine how these generalizations apply to a particular TBI survivor.

There are several mechanisms of recovery after brain injury. Initial improvement may be due to the reduction of swelling (edema) of brain tissue occurring over days, weeks or months, depending on the severity of the injury. Next, damaged brain cells begin functioning again, usually over a period weeks to months. Finally, undamaged areas of the brain may, to a certain extent, take over the functions of areas that suffer permanent damage.

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