Spinal Cord Injury (SCI)

This brochure will help you learn about what to expect after a spinal cord injury (SCI). It describes the 3 phases of recovery:

- Intensive Care
- Acute Care
- Rehabilitation

To better understand the special care and treatment during these phases, it is helpful to learn more about the spine.

The Spine

The spine consists of the spinal column and spinal cord (see Figure 1).

Figure 1: Spine

The **spinal column** is made up of a group of bones (vertebrae) that surround, support, and protect the spinal cord. Between each vertebra is a disc. The disc acts as a shock absorber, and prevents the bones from rubbing together.
The spinal cord is a group of nerves inside the spinal column. It starts at the base of the brain and extends to the tail bone. These nerves send and receive signals between the brain and the rest of the body that allow us to feel:

- Touch
- Pain/pressure
- Temperature
- Position

Other signals allow us to control our arms and legs, as well as other body functions.

The spine is divided into sections according to the location and number of vertebrae. Each vertebra is known by the letter and number that refer to its place on the spine. For example, the 4th vertebra in the cervical spine is called C4.

**Spinal Cord Injury (SCI)**

The spinal cord can be injured by accidents or trauma, sports injuries, infections, tumors, bone diseases, or a decreased blood supply. When the spine is damaged, it may cause changes in the ability to:

- Feel (sensation to the skin)
- Move (motor function)
- Control certain body functions (passing urine or stool)

The type and degree of damage is depends on:

- Where the spine is injured (cervical, thoracic, lumbar or sacral spinal areas).
- The severity of the injury.
- How much of the spine is affected.

A sudden (acute) SCI is caused by a trauma that results in a bruise, partial injury or complete injury to the spinal cord. Most acute injuries occur in areas where the spine has the most movement. These are the:

- Cervical spine at the back of the neck.
- Thoracic-lumbar spine from the trunk to the lower back.

**Effects of SCI**

An injury to the spinal cord affects movement and feeling below the damaged area. Therefore, the higher the level the injury, the more severe the symptoms may be.

Cervical SCI affects the spine between vertebrae C1 through C7. This may cause changes in:

- Feeling to the arms and below chest level (numbness, tingling, loss of feeling).
- Movement of arms and legs (weakness or loss of movement-paralysis).
- Ability to breathe normally.
- Bowel, bladder, and sexual function.
Thoracic SCI affects the spine between vertebrae T1 through T12. This may cause changes in:

- Feeling below the chest.
- Movement below the waist.
- Bowel, bladder, and sexual function.

Lumbar SCI affects the spine between vertebrae L1 through L5. This may cause changes in:

- Feeling below the waist.
- Movement of the legs.
- Bowel, bladder, and sexual function.

Sacral SCI affects the spine vertebrae S1 through S5. This may cause changes in bowel, bladder, and sexual function.

**Types of SCI**

SCI may be classified by the severity of the injury and the extent of the injury. The severity of injury describes how much of the spinal cord has been damaged. The damage may be partial or complete.

- **Partial SCI**
  This is sometimes called an incomplete injury. Some nerve signals are still sent between the brain and the rest of the body. Some feeling and function remains below the area of damage.

- **Complete SCI**
  Signals between the brain and the body are blocked. Little or no feeling or function remains below the area that is injured.

The extent of the injury refers to the amount feeling and function that has been affected in the body.

- **Paraplegia**
  This refers to how much feeling and function has been lost below the waist. It depends on whether the injury was partial or complete.

- **Tetraplegia** (also known as quadriplegia)
  This refers to how much feeling and function has been lost below the neck level. Chest and abdominal muscles may be affected. If the breathing muscles are affected, a breathing machine may be needed. The feeling and function that remains depends on whether the injury was partial or complete.
Care and Treatment

Tests
To find out more about the injury, doctors may order several tests while in the hospital. These tests may include:

- **Myelogram**: Shows the location of injury.
- **CT Scan**: Shows the type of injury to the spinal cord.
- **Somato-Sensory Evoked Potential (SSEP)**: Helps to determine if the SCI is complete or incomplete.
- **Magnetic Resonance Imaging (MRI)**: Shows the type of injury to the spinal cord.
- **X-rays**: Show damage to the bones of the spinal column.

Test results will help the doctors decide how to manage the injured spine. Some patients may need surgery, while others need bedrest and/or a brace.

Surgery
The most common surgery is called a spinal fusion. Two or more bones in the spine are joined together so there is no movement between them. The goal of this operation is to:

- Make the spine stable so it can heal correctly
- Decrease the pain from the injury
- Prevent further loss of feeling and movement

Spinal fusion may not always be able to reverse the loss of feeling or movement.

The surgeon may use a bone graft, metal plates, rods, or wires to straighten and support the spine. After the surgery, the patient will wear a brace for about 3 months until the bones have completely healed.

Braces/Orthotics
Different kinds of support braces called orthotics or orthoses are used to keep the spine from twisting and moving out of place while healing. Orthoses are usually used after an injury or after surgery to:

- Keep the spine straight
- Prevent further injury to the spine

When wearing a brace, the patient may be able to sit, stand, or walk safely. Braces are generally worn for 3 months while the spine heals. The nurse will teach the patient and family how to use and care for the brace. The most common types are:

Cervical Spine Braces
- Soft cervical collar: Made of cloth and foam, this collar provides light support and comfort to the back of the neck and under the chin. It does not prevent movement. Rather it serves to remind the user to limit side-to-side and forward-back head movement.
- Hard or rigid cervical collar: Made of plastic, this collar restricts side-to-side and front-to-back head movement. It supports the back of the neck, base of the head, and under the chin. (Examples include Philadelphia™, Aspen™, and Miami J™ collars).

- Poster-type: These are usually made of aluminum and plastic and consist of 3 parts (head, chin, and chest pieces). It supports the cervical spine and restricts movement. (Examples include SOMI, a 4-poster, and Guilford™, a 2-poster orthoses).

- Halo: These are for patients who require the most cervical support. The halo consists of a metal ring around the head. The halo is held in place with metal pins, and is secured to 2 metal rods attached to a vest worn around the chest.

- Cervical–Thoracic Orthoses (CTO): These braces extend from the chin to the chest and prevents movement between the cervical spine and chest.

**Non-Cervical Spine Braces**

T.L.S.O (Thoraco-Lumbar-Sacral-Orthosis). This is a plastic, shell-like brace that protects the middle to lower spine. It is specially custom-molded to fit the patient. The TLSO prevents twisting and bending at the waist. It fits snugly around the chest and back and extends from the upper chest to the sacral area. The front and back pieces are attached with velcro.

**Hospital Stay – Intensive Care**

The Intensive Care Unit (ICU) provides care for patients that need in-depth monitoring and treatment. The ICU team closely monitors the patient and develops a plan to ensure the best care and treatment. This team includes:

- Doctors that specialize in spinal cord injuries (neurosurgery, orthopedics and ICU care).
- Advanced Practice Nurses and RNs who are skilled in ICU care.
- Physical and Occupational therapists who help the patient to regain the most function.
- Speech-Language Pathologists who help evaluate and treat swallowing or communication problems.
- Respiratory therapists who help manage complex breathing needs.
- Pharmacists who help manage medication treatments.
- Dietitians who help ensure patients are receiving adequate nutrition to help healing.
- Chaplains who provide spiritual support to patients and families.
- Social workers and case managers that provide assistance and resources to patients and families during the hospital stay (financial and insurance; home care, rehabilitation services, etc.).
Care and treatment in the ICU may include:

- A breathing tube and machine to help breathing (ventilator).
- Monitors to watch heart rate, blood pressure and breathing.
- Testing of the areas affected by the injury (feeling, movement).
- Special beds or traction to keep the spine straight and help it heal.
- Medications to help:
  - Reduce swelling and improve spinal cord function.
  - Treat pain or spasms from injury or swelling.
  - Control heart rate and/or blood pressure.
  - Ease digestive problems.
  - Maintain bowel or bladder function.
  - Healing of skin, muscles and bone.

**Medicines**

Some types of medicines that are used include:

- **Steroids** reduce the swelling that surrounds the injured area of the spinal cord. This may help reduce or relieve paralysis.

- **Pain medicines** may include:
  - Narcotics (Dilaudid®, Morphine, Norco®, or Vicodin®).
  - Non-steroidal anti-inflammatory medications (NSAIDS, such as Toradol®, Motrin®, Advil®) help reduce inflammation that can cause pain.
  - Anti-spasmodics (Baclofen®, Flexeril®, Valium®) help prevent painful spasms or spasticity that can muscles to become stiff and interfere with movement.
  - Neuropathic pain medicines help treat pain caused by nerve damage (Neurontin®, Lyrica®).

- **Nutrition supplements** may be given to help healing.

- **Insulin** is used to treat high blood sugar. This is a common side effect of steroids.

- **Bowel medicines** help with regular bowel movements. Constipation is a common problem after SCI.

**Possible Complications**

Care also focuses on preventing complications, such as:

- **Blood Clots** – known as Deep Vein Thrombosis (DVT) and Pulmonary Embolus (PE). Some treatments to prevent blood clots include:
  - Sequential Compression Devices (SCD) are placed on the legs to help the blood circulate. The sleeves gently message the legs and prevent blood clots that can lead to DVT and PE.
  - Anti-coagulation (blood thinning) medicines may be given to prevent blood clots.
  - Range of Motion exercises may be done to ease muscle movement and promote blood flow.
- Some people are at higher risk for getting blood clots. If needed, a filter may be placed in a large vein to keep blood clots from traveling to the lungs.

- **Stomach/Stress Ulcers**—Medicines may be given to protect the stomach lining or decrease the acid in the stomach.

- **Pneumonia**—Turning, coughing, deep breathing exercises along with other treatments are used to help prevent pneumonia. Sometimes antibiotics are needed. Patients who need a breathing machine for long periods will also receive special care to prevent and treat pneumonia.

- **Bladder (Urinary Tract) infections (UTI)**—Infections caused by catheters in the bladder to drain urine are treated with antibiotics.

- **Pressure Sores**—Pressure on certain bony areas from laying or sitting create red areas that can become open sores. The nurse often inspects the skin. To prevent pressure sores, patients:
  - Are turned every 2 hours
  - Sleep on a special bed
  - Sit for short periods of time on special pads (when out of bed)

  These actions are started in the hospital and must continue as long as the patient is unable to change positions on their own. The most common bony areas of the body to develop pressure sores include:
  - Lower back (tailbone) and buttocks
  - Hips
  - Heels and ankles
  - Shoulder blades

  Sores are treated by removing the sources of pressure and applying special dressings to help healing.

After a SCI, patients may develop **Spinal Shock**. This is a short-term condition that causes loss of reflexes, feeling, or movement below the level of injury. It may last for several hours to days. The true extent of injury may not be known until spinal shock has passed.

Another possible effect of SCI is known as **Autonomic Dysreflexia**. This may occur in injuries above the 6th thoracic vertebra (T6). The body reacts with abnormal reflexes that cause high blood pressure, headache, sweating and chills or fever. The health care team is skilled in recognizing and treating this condition.

**Leaving the ICU—Acute Care**

When patients no longer need intensive care, they will be transferred to an acute care unit in the hospital. The health care team that provides care during the acute care phase are specially trained in the care of SCI patients.
Care and treatment includes:

- Monitoring of the condition of the patient
- Providing patient and family education
- Providing physical and occupational therapy
- Assessing rehabilitation needs
- Developing a discharge plan
- Preventing complications

How long a patient stays in the hospital depends on where the spine is injured, what other injuries occur, and any complications. When ready, patients are transferred to rehabilitation centers, centers for extended care, or to their homes.

**Rehabilitation (Rehab)**

SCI rehabilitation begins as soon as possible after injury which often means in the intensive care unit. Rehabilitation continues until goals have been met and the patient returns to the community. The goal of rehab is to regain the most function possible after SCI. The rehab process begins when the patient is evaluated by a physiatrist in the acute care unit. A physiatrist is a doctor that is also a rehabilitation specialist. The physiatrist works with the rehab team to decide what type of therapy is best for the patient.

The rehab team may consist of:

- Physical Therapists
- Occupational therapists
- Speech language pathologists
- Social Workers
- Psychologists
- Rehab nurse

Rehabilitation is not limited to a single area. Therapy may occur at the bedside or other areas of the hospital. Therapy focuses on:

- The needs and goals of the patient
- Returning to home, work, or school

Patients are urged and expected to take an active role in their rehab program.

**Medical Care**

The physiatrist directs the medical care of the patient during the rehab phase of treatment. This care includes assessment and management of:

- Bowel and bladder function.
- Skin care and prevention of pressure ulcers
- Pain and spasticity
- Contractures
- Nervous system symptoms and conditions
- Future sexual function

**Nursing**
Nurses assess the patient’s condition from admission through discharge and carry out the plan of care to:
- Meet the patient’s care needs; prevent and manage any complications.
- Support and educate patients and families to help them understand their care.
- Work with patients, families and the rehab team to help patients meet their rehab goals.

**Occupational Therapy (OT)**
The goal of OT is to help patients regain the most function possible and achieve the highest level of independence. OT helps patients learn how to:
- Care for themselves (for example, bathing, dressing).
- Use of assistive devices and adaptive equipment (for example splints, raised toilet seats, and shower chairs) to make self care possible.
- Improve arm and hand strength and coordination.
- Develop job and lifestyle skills.

**Physical Therapy (PT)**
PT focuses on improving balance, strengthening muscles, and coordinating activity. The treatment plan includes learning how to:
- Get in and out of bed
- Transfer between bed, chair, tub, toilet and other sites, using physical aids as needed
- Walk or use a wheelchair
- Direct a caregiver to provide help

OT and PT may occur in private or group settings to prepare patients to return to their community.

**Speech Therapy**
Speech and swallowing therapy focuses on improving:
- Eating and swallowing
- Speaking clearly
- Thinking and understanding speech
- Reading and writing
- Communication methods for patients unable to speak or write

**Rehabilitation Psychology**
The psychologist evaluates each patient’s response to their injury and provides counseling to patients and families.
**Social Work/Case Management**
The social worker and case manager work with the family to plan for care and rehabilitation needs after discharge from the hospital and/or rehab center. They provide psychosocial support, as well as educating patients/families about community resources and financial support services.

**Therapeutic Recreation**
This activity supports rehab goals by using leisure interests, hobbies, and social activities to help patients improve function, and enhance emotional well-being and quality of life.

**Vocational Rehabilitation**
If available, vocational rehab may offer services to help patients return to school or work.

**Northwestern Medicine—Health Information Resources**
For more information, contact Northwestern Memorial Hospital’s Alberto Culver Health Learning Center (HLC) at hlc@nm.org, or by calling 312.926.5465. You may also visit the HLC on the 3rd floor, Galter Pavilion at 251 E. Huron St., Chicago, IL. Health information professionals can help you find the information you need and provide you with personal support at no charge.

For more information about Northwestern Medicine, please visit our website at nm.org.