

CHAPTER IV

SPINAL CORD INJURY

(i) Definition

Spinal Cord Injury: Break up in the line of communication between the brain and the muscle due to damage to the Spinal Cord.

Quadriplegia: (Paralysis neck down)

Paraplegia: (Paralysis waist down)

Significantly alters every aspect of a person's life.

(ii) Causes of spinal cord injury:

- Paraplegia according to a layman occurs only when there is some sort of injury, in the brain, or the spinal cord.
- But there are cases where there has been no presence of any trauma (injury) and the individual has been affected by the problem due to congenital conditions, compressions in the spinal cord, tuberculous disease of the spine, crush fracture, spinal meninges, or even spinal cord tumours like gliomass, metasatic deposits.
- Some of the causes can be classified as Trauma, Prostate tumour, Bony metastases, Multiple myeloma, Osteoporosis, Hereditary Spastic paraplegia, Spina Bifida, Multiple sclerosis, infections, hypotension, acute bloodloss, vitamin deficiencies, HIV, motor neurone disease, stroke etc
- Paraplegia can be caused even by something as simple as medication side effect.
- All these causes in some way or the other, directly or indirectly, affect the spinal cord causing damage to the nervous system, leading to the ailment. Paraplegia is mainly about the damage which happens to the Central nervous system (CNS) or the Peripheral nervous system.
- In India lathyrism is considered to be an important cause of paraplegia. Lathyrism or Neurolathyrism is a neurological disease of humans and domestic animals caused by eating of certain legumes of the genus Lathyrus.
- Apart from medical grounds, causes of paraplegia can also be distinguished on the basis of age, namely, paediatric, adult and elderly (old age).

(iii) Technical Explanation to Paraplegia

- Any disease process affecting the pyramidal tract of the spinal cord from the thoracic spine downward may lead to paraplegia. It is the most common cause of paraplegia (damage to CNS). It is usually spastic and results in an increased muscle tone in the affected limbs.
- Rarer is the type of paraplegia which is caused by damage to the nerves supplying the legs. This form of damage is not usually symmetrical and would not cause paraplegia, but polyneuropathy may cause paraplegia if the motor nerves are affected. While in theory the arms should also be affected, the fibres that supply the legs are longer and hence more vulnerable to damage (PNS).

Disability & Degree: While some people with paraplegia can walk to a degree, many are dependent on wheelchairs or other supportive measures.

Power: This can be understood in terms of **Power**. The power of all the muscles is tested at each joint in both the upper and the lower limbs both against gravity and against resistance. Power in individual is graded as follows:

Grade 0: No Power

Grade 1: Flicker of contraction only

Grade 2: Movement with gravity eliminated

Grade 3: Movement against resistance

Grade 4: Movement against gravity and some resistance

Grade 5: Normal power

- As far as sensations are concerned, the patient is tested for pain, touch, temperature, position, vibrations and cortical sense.

Treatment

- Even in this modern age, there is no specific treatment available for paraplegia, which can guarantee 100% results. Treatments will differ according to the cause of paraplegia.
- Physiotherapy gives a very good result.
- Surgery is also used as an option
- Some institutes are also trying to use acupressure and acupuncture treatments to help the patients. Though this has not been scientifically proved stem cell treatment has great potential but still in its embryonic stage.

There are various causes for disability. Spinal Cord Injury is one such reason which leads to permanent disability. Surgery and comprehensive rehabilitation are de riguer for a good quality of healthy life. It is important to understand the human body and spinal cord functioning to fathom the gravity of this issue.

2. Understanding Spinal Cord Injury

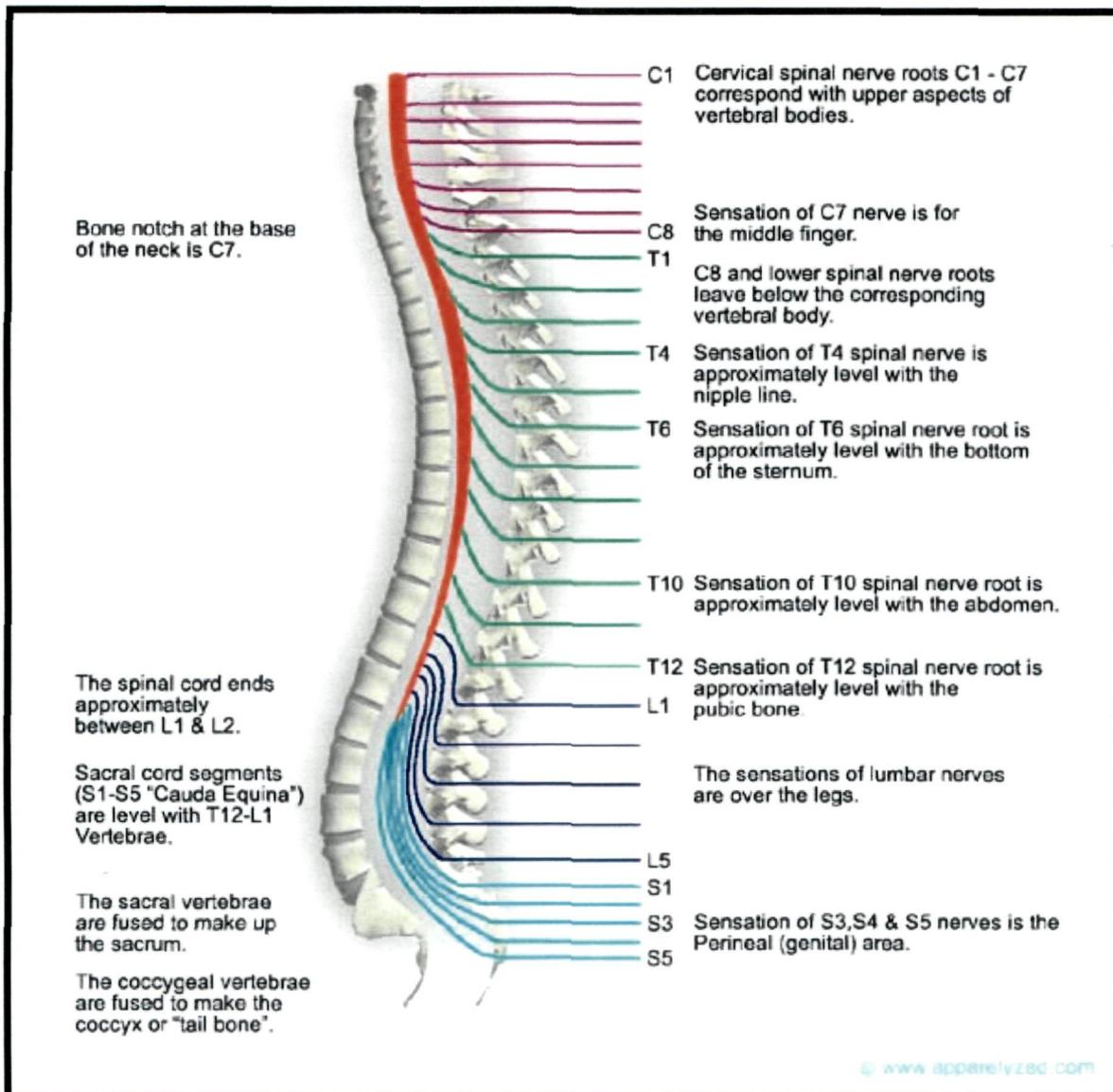
i. What is Spinal Cord Injury?

Spinal Cord Injury (SCI) is damage to the spinal cord that results in a loss of function such as mobility or feeling. Frequent causes of damage are trauma (car accident, gunshot, falls, etc.) or disease (tumours, TB Spine etc). The spinal cord does not have to be severed in order for a loss of functioning to occur. In fact, in most people with Spinal Cord Injury, the spinal cord is intact, but the damage to it results in loss of functioning. Spinal Cord Injury is very different from back injuries such as ruptured disks, spinal stenosis or pinched nerves.

A person can "break their back or neck" yet not sustain a spinal cord injury if only the bones around the spinal cord (the vertebrae) are damaged, but the spinal cord is not affected. In these situations, the individual may not experience paralysis after the bones are stabilized.

ii. Spinal cord and the vertebra

The spinal cord is the major bundle of nerves that carries nerve impulses to and from the brain to the rest of the body. The brain and the spinal cord constitute the Central Nervous System.



Motor and sensory nerves outside the central nervous system constitute the Peripheral Nervous System, and another diffuse system of nerves that control involuntary functions such as blood pressure and temperature regulation are the Sympathetic and Parasympathetic Nervous Systems. The spinal cord is surrounded by rings of bone called vertebra. These bones constitute the spinal column (back bones). In general, the higher in the spinal column the injury occurs, the

more dysfunction a person will experience. The vertebra is named according to their location. The eight vertebrae in the neck are called the Cervical Vertebra. The top vertebra is called C-1, the next is C-2, etc. Cervical Spinal Cord Injury usually cause loss of function in the arms and legs, resulting in quadriplegia. The twelve vertebrae in the chest are called the Thoracic Vertebra. The first thoracic vertebra, T-1, is the vertebra where the top rib attaches. Injuries in the thoracic region usually affect the chest and the legs and result in paraplegia. The vertebrae in the lower back - between the thoracic vertebra, where the ribs attach, and the pelvis (hip bone), are the Lumbar Vertebra. The sacral vertebra run from the pelvis to the end of the spinal column. Injuries to the five Lumbar vertebra (L-1 thru L-5) and similarly to the five Sacral Vertebra (S-1 thru S-5) generally result in some loss of functioning in the hips and legs.

iii. Effects of Spinal Cord Injury

The effects of Spinal Cord Injury depend on the type of injury and the level of the injury.

Spinal Cord Injury can be divided into two types of injury - complete and incomplete. A complete injury means that there is no function below the level of the injury; no sensation and no voluntary movement. Both sides of the body are equally affected. An incomplete injury means that there is some functioning below the primary level of the injury. A person with an incomplete injury may be able to move one limb more than another, may be able to feel parts of the body that cannot be moved, or may have more functioning on one side of the body than the other. With the advances in acute treatment of Spinal Cord Injury, incomplete injuries are becoming more common. The level of injury is very helpful in predicting what parts of the body might be affected by paralysis and loss of function. In incomplete injuries there will be some variation in these prognoses. Cervical (neck) injuries usually result in quadriplegia.

Injuries above the C-4 level may require a ventilator for the person to breathe. C-5 injuries often result in shoulder and biceps control, but no control at the wrist or hand. C-6 injuries generally yield wrist control, but no hand function. Individuals with C-7 and T-1 injuries can straighten their arms but still may have dexterity problems with the hand and fingers. Injuries at the thoracic level and below result in paraplegia, with the hands not affected. At T-1 to T-8 there is most often control of the hands, but poor trunk control as the result of lack of abdominal muscle control. Lower T-injuries (T-9 to T-12) allow good trunk control and good

abdominal muscle control. Sitting balance is very good. Lumbar and Sacral injuries yield decreasing control of the hip flexors and legs.

Besides a loss of sensation or motor functioning, individuals with Spinal Cord Injury also experience other changes. For example, they may experience dysfunction of the bowel and bladder. Sexual functioning is frequently affected: men with Spinal Cord Injury may have their fertility affected, while women's fertility is generally not affected. Very high injuries (C-1, C-2) can result in a loss of many involuntary functions including the ability to breathe, necessitating breathing aids such as mechanical ventilators or diaphragmatic pacemakers. Other effects of Spinal Cord Injury may include low blood pressure, inability to regulate blood pressure effectively, reduced control of body temperature, inability to sweat below the level of injury, and chronic pain.

iv. Total No. of people with Spinal Cord Injury

2.5 million people with Spinal Cord Injury in 2005 as per CARF – Commission on Accreditation of Rehabilitation facilities (USA). In India, it is hypothesised that there are 3 lac people with spinal cord injury currently. The global benchmark is 20 per million population. This formula would mean 20 per million for our 1.1 billion population which would mean 10 lac people with spinal cord injury, Considering the average life span of people with spinal cord injury to be 50 years, the figure regarding the total number of people with Spinal Cord Injury seems to be high. This may be due to the fact that we have erred in presuming that on an average a spinal injured lives for 50 years after the spinal injury. However, it may be more reasonable to presume that the life span of a spinal injured on an average would be 50 years. This also may not be true since many of the high cervical spine injuries do not survive. However, taking the average life span as 50 years and the average age of injury at 35 years, number of people with Spinal Cord Injury at any point of time would be $20,000 \times 15$ (50 average life span less 35 age at the time of injury) or approximately 3,00,000. For the purpose of study it is 3,00,000 people with spinal cord injury.

v. Cure for Spinal Cord Injury

Currently there is no cure for Spinal Cord Injury. There are many researchers attacking this problem, and there have been many advances in the lab. Many of the most exciting advances have resulted in a decrease in damage at the time of the injury. Steroid drugs such as methylprednisolone reduce swelling, which is a common cause of secondary damage at the time of injury. The experimental drug Sygen® appears to reduce loss of function, although the mechanism is not completely understood. Stem Cell treatment both embryonic and bone marrow are conducting clinical trials but to no real revolutionary improvements. Spinal implants are also being explored. The results may take another few decades. Stem cell therapy and treatment is a promising field, but not likely to be operational, with 100% results for the next 10 – 20 years. Currently these are all experiments and not even at clinical trial stage.

vi. Do people with Spinal Cord Injury get better?

When a Spinal Cord Injury occurs, there is usually swelling of the spinal cord. This may cause changes in virtually every system in the body. After days or weeks, the swelling begins to go down and people may regain some functioning. With many injuries, especially incomplete injuries, the individual may recover some functioning as late as 18 months after the injury. In very rare cases, people with Spinal Cord Injury will regain some functioning years after the injury. However, only a very small fraction of individuals sustaining Spinal Cord Injury recover all functioning.

vii. Does everyone who sustains Spinal Cord Injury use a wheelchair?

No. Wheelchairs are a tool for mobility. High C-level injuries usually require that the individual use a power wheelchair. Low C-level injuries and below usually allow the person to use a manual chair. Advantages of manual chairs are that they cost less, weigh less, disassemble into smaller pieces and are more agile. However, for the person who needs a powerchair, the independence afforded by them is worth the limitations. Some people are able to use braces and crutches for ambulation. These methods of mobility do not mean that the person will never use a wheelchair. Many people who use braces still find wheelchairs more useful for longer distances. However, the therapeutic and activity levels allowed by standing

or walking briefly may make braces a reasonable alternative for some people. Of course, people who use wheelchairs aren't always in them. They drive, swim, fly planes, ski, and do many activities out of their chair. If you hang around people who use wheelchairs long enough, you may see them sitting in the grass pulling weeds, sitting on your couch, or playing on the floor with children or pets. And of course, people who use wheelchairs don't sleep in them, they sleep in a bed. No one is "wheelchair bound."

viii. Do people with Spinal Cord Injury die sooner?

Yes. Before World War II, most people who sustained Spinal Cord Injury died within weeks of their injury due to urinary dysfunction, respiratory infection or bedsores. With the advent of modern antibiotics, modern materials such as plastics and latex, and better procedures for dealing with the everyday issues of living with Spinal Cord Injury, many people approach the lifespan of non-disabled individuals. Interestingly, other than level of injury, the type of rehabilitation facility used is the greatest indicator of long-term survival. This illustrates the importance of and the difference made by going to a facility that specializes in SCI. People who use vents are at some increased danger of dying from pneumonia or respiratory infection, but modern technology is improving in that area as well. Pressure sores are another common cause of hospitalization, and if not treated - death.

ix. Do people with Spinal Cord Injury have jobs?

People with Spinal Cord Injury have the same desires as other people. That includes a desire to work and be productive. The persons with Disabilities Act 1995 promote the inclusion of people with Spinal Cord Injury to mainstreaming day-to-day society. Of course, people with disabilities may need some changes to make their workplace more accessible, but surveys indicate that the cost of making accommodations to the workplace in 70% of cases is \$500 or less.

x. Can people with Spinal Cord Injury have sex, children?

Spinal Cord Injury frequently affects sexual functioning. However, there are many therapies that allow people with Spinal Cord Injury to have an active and satisfying sex life. Fertility is also frequently affected in men with Spinal Cord Injury. Methods similar to those used for non-disabled men with fertility problems have allowed many men with Spinal Cord Injury to father their own children. Of course, adoption is another option. The fertility of women with Spinal Cord Injury may be affected in the first months after injury. However, most women regain the ability to become pregnant after Spinal Cord Injury. Many women with Spinal Cord Injury are able to carry babies to full term. However, it is important that she consult a physician experienced in Spinal Cord Injury.

xi. What do we say when we meet a person with Spinal Cord Injury?

Hi. A person with a Spinal Cord Injury is no different from a non-disabled individual except in a few ways. People with Spinal Cord Injury have the same hopes, interests and desires as other people. People with Spinal Cord Injury are interested in sports - or not (just like non-disabled people). Although disabled individuals do some things differently than non-disabled individuals, the result is the same. It's important to remember that although Spinal Cord Injury changes a person, they are still people, so we need to treat them that way.

xii. What is the most important hope for Spinal Cord Injury?

Rehabilitation is the only solution for a full, active and independent life. **The most important thing to remember is: *Life does not end with spinal cord injury.*** Rehabilitation is the key for a good quality of life. The abilities have to be tapped to contribute the maximum to family, profession and society.

Causes of Spinal Cord Injury

1. Trauma caused due to accidents:

- Vehicle
- Gunshot
- Fall from height

2. Adventure sports:

- Biking
- Scuba diving
- Rock climbing
- River rafting
- Surfing
- Paragliding

3. (or) Due to diseases of the spine