International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2022; 8(1): 472-474

www.orthopaper.com
Received: 13-11-2021
Accepted: 19-12-2021

Dr. Vidyasagar Boraiah
Senior Resident, Department of Orthopadics, Mandya Institute of Medical Sciences, Mandya, Karnataka, India

Dr. Sunil Kumar AS
Senior Resident,
Department of Orthopadics
Pgimer, Chandigarh, India

Corresponding Author:
Dr. Sunil Kumar AS
Senior Resident,
Department of Orthopadics
Pgimer, Chandigarh, India

Spinal cord injury

Dr. Vidyasagar Boraiah and Dr. Sunil Kumar AS

DOI: https://doi.org/10.22271/ortho.2022.v8.i1g.3057

Abstract
A spinal cord injury (SCI) is damage to any part of the spinal cord or nerves extending from the spinal cord that often results in permanent changes in motor and/or sensory abilities and other body functions below the point of the injury. The physical impairments from SCI vary as a function of the level and completeness of the injury. Nearly every aspect of a person's life physical health, work, personal relationships, and recreation may be affected following SCI. Adjustment involves learning new adaptive behaviors and attitudinal change, so psychologists play a crucial role in assisting the rehabilitation process. This self-directed learning module highlights basic management and approaches to intervention both established and experimental. The revised American Spinal Injury As sociation classification of spinal cord injury (SCI) further defines the examination and classification guidelines. The incidence of traumatic SCI remains at approximately 10,000 cases per year, with 32 years the average age at injury. Initial management includes establishment of oxygenation, circulation (mean blood pressure >85mmHg), radiographic evaluations for spine instability, intravenous methylprednisolone, and establishment of spinal alignment. Prevention measures for medical complications include pressure relief for skin, thromboembolism prophylaxis, prevention of gastric ulcers, Foley catheter drainage to prevent urine retention, and bowel care to prevent colonic impaction. Nontraumatic SCI from spinal stenosis, neoplastic compression, abscess, or multiple sclerosis becomes more common with aging. Experimental treatments for SCI include antibodies to block axonal growth inhibitors, gangliosides to augment neurite growth, 4-aminopyridine to enhance axonal conduction through demyelinated nerve fibers, and fetal tissue to fill voids in cystic spinal cord cavities. Early comprehensive rehabilitation at a SCI center prevents complications and enhances functional gains.

Keywords: Spinal cord injury (SCI), damage to any part, permanent changes, body functions

Introduction
The incidence of traumatic spinal cord injury (T/SCI) is approximately 40 new cases per million population, or just over 10,000 cases per year, This figure does not include persons who die at the accident scene. The mean age at injury is 31.8 years, with 59% being at or below the age of 30 years at the time of injury. ~The injury rate for men is 4 times that of women. Gunshot wounds are overall the third most common cause of new T/SCI in the United States and the second leading cause of cases since 1990, behind motor vehicle crashes. The most accurate way to document impairments in a person with a new SCI is by performing a standardized neurologic examination as endorsed by the International Standards for Neurological Classification of Spinal Cord Injury Patients, 2 also commonly called the American Spinal Injury Association (ASIA) guidelines. These standards provide basic definitions of the most common terms used by clinicians in the assessment of SCI and describe the neurologic examination. Key terms used in T/SCI are defined in table 1. This examination should be performed in addition to other aspects of the comprehensive evaluation of a newly injured individual. If traumatic brain injury (TBI) is suspected, additional evaluation is required. 3 The neurologic examination of the person with SCI has 2 main components: sensory and motor. The required elements permit the examiner to determine the sensory, motor, and neurologic levels of injury; to generate sensory and motor index scores; to determine the completeness of the injury; and to help classify the impairment. The information from this neurologic examination can be recorded on a standardized flow sheet that should be included in the medical records. Using a standard method of neurologic assessment is important to help determine the course of recovery and the effect of interventions in the treatment of SCI, including regeneration.

For the sensory examination, there are 28 key dermatomes, each separately tested for pinprick and dull and light touch on each side of the body. A 3-point scale (range, 0 - 2) is used, with the face as the normal control point. Absent pinprick, a score of zero, is defined as the inability to distinguish between the sharp and dull edge of the pin. Impaired sensation, a score of 1 for pinprick testing, is assigned when the patient can distinguish between the sharp and dull edge of the pin, but the pin is not felt as sharply as on the face. Normal or intact sensation, a score of 2, is assigned only if the pin is felt as sharply in the tested dermatome as when tested on the face. To test for deep anal sensation, a digital rectal examination is performed. The patient is asked to report any sensory awareness, touch, or pressure, with firm pressure of the examiner's digit on the rectal wall. Deep anal sensation is recorded as either present or absent. The required elements of the motor examination consist of strength grading of 10 key muscles bilaterally: 5 in the upper limb (C5-T1 myotomes) and 5 in the lower limb (L2-S1) on each side of the body. Testing of key muscles is performed with the patient in the supine position and is graded on a 6-point scale (range, 0-5). Voluntary anal contraction is tested by sensing contraction of the external anal sphincter around the examiner's finger and graded as either present or absent. A Beevor's sign can be elicited by requesting a contraction of the abdominal muscles and may help determine if the patient has a lesion above or below T10. This test should not be performed during the acute stages of thoracic or lumbar injuries. The neurologic level of injury (NLI) is the most caudal level at which both motor and sensory modalities are intact on both sides of the body. The motor and/or sensory level may be different from side to side. In fact, the motor and sensory levels are the same in less than 50% of complete injuries, and the motor level may be multiple levels below the sensory level at 1 year postinjury.4 In cases in which there is no key muscle for a segment that has sensory dermatomes intact (high cervical levels including C4 and above; T2-L1; sacral levels $2-5), the motor level, and therefore the neurologic level, is that which corresponds to the sensory level. The motor level and upper extremity motor index score better reflect the degree of function as well as the severity of impairment and disability, relative to the NLI, after motor complete tetraplegia. 4 Many systems have been developed for the classification of SCI. In 1982, the ASIA first developed and published a booklet, Standards for Neurological Classification of SCI, adopting the Frankel Scale.5 These standards were refined over the next 10 years, with the Frankel Scale being replaced in 1992 by the ASIA Impairment Scale,6 which was revised in 1996 and again in 2000 (table 2). 2 The 2000 revision clarified the following issues from the previous standards. First, for an individual to receive an ASIA classification of "motor incomplete" (ASIA class C or D), he/she must have either (1) voluntary anal sphincter contraction or (2) sensory sacral sparing with sparing of motor function more than 3 levels below the motor level. Previously, the person only needed to have sparing more than 2 levels below the motor level. Another major change in the 2000 revision is the elimination of the FIM .... instrument from the standards. Last, there is a change in how the zone of partial preservation (ZPP) is to be documented. Only the most caudal segment with some sensory and/or motor function should be recorded on the neurologic form for sensory and motor function bilaterally. For example, if the fight sensory level is C5 and some sensation extends to C8, then C8 is recorded in the fight sensory ZPP block on the classification form. Table 3 lists a summary of the steps to be followed in classifying an individual with a SCI.

Table 1: Glossary of key terms

Key muscle groups: Ten muscle groups that are tested as part of the standardized spinal cord examination.

Root Level	Muscle Group	Root Level	Muscle Group
C5	Elbow flexors	L2	Hip flexors
C6	Wrist extensors	L3	Knee extensors
C7	Elbow extensors	L4	Ankle dorsiflexors
C8	Long finger flexors	L5	Long toe extensor
T1	Small finger abductors	S1	Ankle plantarflexors

Motor level: The most caudal key muscle group that is graded 3/5 or greater with the segments cephalad graded normal (5/5) strength.

Motor index score: Calculated by adding the muscle scores of each key muscle group; a total score of 100 is possible.

Sensory level: The most caudal dermatome to have normal sensation for both pin prick and light touch on both sides.

Sensory index score: Calculated by adding the scores for each dermatome; a total score of 112 is possible for each pin prick and light touch.

Neurologic level of injury: The most caudal level at which both motor and sensory function are intact.

Complete injury: The absence of sensory and motor function in the lowest sacral segments.

Incomplete injury: Preservation of motor and/or sensory function below the neurologic level that includes the lowest sacral segments.

Skeletal level: The level at which, by radiologic examination, the greatest vertebral damage is found.

Zone of partial preservation (ZPP): Used only with complete injuries, refers to the dermatomes and myotomes caudal to the neurologic level that remains partially innervated. The most caudal segment with some sensory and/or motor function defines the extent of the ZPP.

Table 2: ASIA impairment Scale (revised 2000)[2]

A = Complete: no motor or sensory function is preserved in the sacral segments S4–5.
B = Incomplete: sensory but no motor function preserved below the neurologic level and includes the sacral segments S4–5.
C = Motor function is preserved below the neurologic level, and more than half of the key muscles below the neurologic level have a muscle grade <3.
D = Incomplete: motor function is preserved below the neurologic level, and at least half of key muscles below the neurologic level have a muscle grade >3.
E = Normal: motor and sensory function are normal.

Management

A. multidisciplinary team approach offers the best chance of a successful outcome following SCI. Medical therapy and rehabilitation are initiated the moment the patient is admitted to hospital. Both go on hand-in-hand. About 50% of the patients have associated injuries to the head, chest, abdomen or appendicular skeleton. Loss of sensations below the level of injury necessitates a very thorough evaluation, clinical and radiological, to rule out hidden injuries. Not all spinal column injuries are associated with injury to the spinal cord. Immobilization of the spine at the site of accident and during transfer has proven to reduce the incidence of neurological complications. Acute care begins with attention to fundamentals of trauma care, i.e., cardiopulmonary resuscitation. A. Airway maintenance with cervical spine control.

B. Breathing.

C. Circulation.
D. Disability.
E. Exposure.

This sequence of assessment must always be adhered to without any exception. If a spinal cord injury is suspected, immediate orthopaedic or neurosurgical consultation must be sought. Indicators of possible spinal cord injury are:
1. Slow heart rate < 60 beats per minute.
2. Hypotension.
3. Abdominal breathing.
4. Inability to move limbs with loss of sensations.

In an unconscious victim, spinal cord injury must always be suspected and appropriate immobilization of spine maintained till it is ruled out by a specialist

Rehabilitation
Advances in the management of spinal cord injured patients have come not from new surgical techniques and tools or drugs but from a holistic approach to the patient. Historically SCI resulted in paralysis, immobility, isolation and mortality. It still results in paralysis but mobility, integration with society and prevention of secondary complications has mitigated its crippling nature. It has been stated "collaboration, not isolation is the key to the success of rehabilitation". Rehabilitation should begin as soon as possible after injury. The objective is to avoid secondary complications. The key to prevention is knowledge and education.

Conservative Versus Surgical Management
Historically, non-operative treatment was the standard. However, recent advances in radiological techniques have led to a better understanding of injury patterns. The crucial issues to consider are stability of the injured spinal column and neurological status. Instability may result in neural tissue damage, progressive deformity and chronic pain. Advances in anaethesiology, critical care, surgical techniques and instrumentations have encouraged aggressive yet safer methods of spinal fixation. Surgical fixation, where indicated, gives superior control of deformity, allows early mobilization, rehabilitation and reduces hospital stay. However, a consensus on the role of surgery and its timing remains elusive. Its role in improving neurological outcome is controversial. The only absolute indication for surgery is progressive neurological deficit. An algorithm for management after spinal injury is shown.

Discussion:
Incidence and Prevalence. SCI is a relatively infrequent but highly visible and costly dis-ability, with an incidence rate of approximately 40 cases of traumatic SCI per million people annually, with a prevalence of approximately 270,000 persons in the United States.
SCI mainly affects younger adults, with half of injuries occurring between the ages of 16 and 30; most (approximately 80 %) are male. African-Americans are overrepresented relative to the U.S. population as a whole, comprising around 23 % of injuries.

- The most common causes of traumatic SCI include moving vehicle crashes (36.5 %), falls (28.5 %), violence (14.3 %), and sports (9.2 %). Violent causes of SCI are much more common among ethnic minority groups. For example, violence accounts for about 44 % of injuries among African-Americans, compared to just 7 % for Caucasians [8]. Lifetime medical costs of having an SCI are high, ranging from 2.1 to 5.4 million dollars, depending on age at injury and injury level.

Conclusion
Language matters: Focus on the person first Avoid outmoded and value- laden language such as "wheelchair bound, confined to a wheelchair," "unfortunate" individual who "suffered" an injury, and so on.

- Normalize stress and intense emotional reactions to disability. In the ideal situation, the psychologist sees every person admitted for rehabilitation, integrating mental health into the overall plan of care and enabling psychological understanding for the team and persons served. Even when psychology is only consulted for problematic cases, it facilitates acceptance to introduce psychological services as a means of addressing quality of life concerns and stress management, rather than as a traditional treatment for mental disorders.

References

1. WHO Bulletin. The Global Economic and Healthcare Burden of Musculoskeletal Disease.
2. Silver JR. History of the Treatment of Spinal Injuries. Postgraduate Medical Journal. 2005;81:108-114.
3. Mukherjee AK. Spine Injury and Disability Care. Vikas Publishing House Pvt. Ltd., New Delhi, 1999.
4. Singh R, Sharma SC, Mittal R, Sharma A. Traumatic Spinal Cord Injuries in Haryana; An Epidemiological Study. Indian Journal of Community Medicine. 2003;28(4):10-12.
5. Kirshblum S, Gonzalez P, Cuccurullo S, Luciano L. Spinal cord injuries. In: Cuccurullo S, editor. Physical medicine and rehabilitation board review. New York: Demos. 2004, 489-552.
6. Gupta A, Taly A, Srivastava A, Vishal S, Murali T. Traumatic vs non-traumatic spinal cord lesions: comparison of neurological and functional outcome after in-patient rehabilitation. Spinal Cord. 2008;46(7):482-7.
7. DeVivo M. Epidemiology of traumatic spinal cord injury: trends and future implications. Spinal Cord. 2012;50(5):365-72.
8. Kennedy P, Chessell Z. Traumatic versus non- traumatic spinal cord injuries: are there differential rehabilitation outcomes? Spinal Cord. 2013;51(7):579-83.
9. McKinley W, Seel R, Gadi R, Tewksbury M. Nontraumatic vs. traumatic spinal cord injury. Am J Phys Med Rehabil. 2001;80(9):693-910.
10. Model Systems Knowledge Translation Center. Skin care and pressure sores part 1: causes and risks of pressure sores. 2009. http://www.msktc.org/lib/docs/ Factsheets/SCI_Skincare_Series_Causes_and_Risks. pdf. Accessed 14 Dec 2015