



Review Article

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Traumatic Spinal Cord Injuries: The Nature of the Beast and Principles of its Management

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Introduction

Traumatic spinal cord injuries (TSCI) are life threatening and life changing events. Fortunately, the incidence of Spinal Cord Injuries is one of the smallest of all medical conditions ranging between 10 to 50 patients/ million population /year. Prior to the second world war the majority of the patients died from complications that developed in the systemic effects of cord damage. With expert simultaneous management of the injured spine together with all the medical and non-medical effects of cord damage from the early hours of injury the impact of a spinal cord injury can be minimized and a significant number of patients with incomplete spinal cord injuries recover motor power to walk again without surgical intervention on the injured spine. The majority of patients with complete cord damage do not recover the ability to walk irrespective of the method of management of the injured spine. With expert care of the injured spine and all the effects of cord damage however, all complications of cord damage can be prevented or diagnosed and treated early to prevent morbidity and mortality as well as prevent further neurological deterioration by mechanical and non-mechanical factors [1-5].

An injury to the spinal cord results in a multi-system physiological impairment and malfunction that includes the spinal cord. An injured, physiologically impaired, and unstable spinal cord is vulnerable to a variety of non-mechanical complications that can easily develop in these patients. Significant hypotension, hypertension, hypoxia, hypothermia, generalized sepsis, electrolytes imbalance have been observed to further destabilize

the injured cord causing manifest neurological deterioration, prevent recovery or delay neurological recovery.

Delays in the diagnoses of complications due to the lack or impairment of sensation and inability of the patient to present the expected symptoms and signs to clinicians are not uncommon. This is due to the rarity of the condition and the little exposure of the majority of clinicians to the management of these patients without training in dedicated Services to the management of spinal cord injuries [6-10].

Currently, unfortunately the resources to manage the medical and non-medical effects of the majority of patients with spinal cord injuries are inadequate and diminishing. Consequently, the devastating wide range of medical, psychological, social, emotional, financial, vocational, environmental, and economic consequences are often poorly managed. The poor management of the medical effects result in the development of a wide range of avoidable complications that affect the patients health and precipitate a vicious circle of added psycho-social and economic burden to patients and all those related to them [11-15].

Successful management of patients with Spinal Cord Injuries requires: an understanding of the patho-physiological changes that occur in the various systems of the body and an infra structure of a knowledgeable, well trained, experienced and well-coordinated multidisciplinary team of health care professionals who treat the patient in an environment that facilitates the complex management

of the condition and reduce the impact of the effects of cord damage on patients and those who care for them.

With expert initial management and ongoing surveillance, care and support, patients with spinal cord injuries can lead healthy, fulfilling, productive, dignified, and enjoyable lives and contribute to their community and society at large [16-20].

Effects and Special Characteristics of Spinal Cord Injury (SCI)

SCI causes a generalized physiological impairment and multi system malfunctions as well as psychological, social, emotional, matrimonial, financial, vocational, environmental, and economic problems to the individual. Those individuals related to the patient are at least similarly affected by the non-medical effects of the injury. Due to the loss of autoregulatory mechanisms, loss of blood brain barrier and due to several cell membrane cellular and metabolic disturbance, the Injured Spinal Cord (SC) is Physiologically impaired and Unstable. Unlike the undamaged spinal cord, the injured SC is vulnerable to complications outside of the spinal canal. Hypoxia, hypotension, sepsis can easily occur and can result in further neurological deterioration, delay or lack of recovery.

The function of the various systems of the body depends on the reflex activity of the spinal cord segments distal to the lesion as well as the intrinsic property of the individual body system. Changes in level of reflex activity of the injured SC is likely to occur during the patient's life and affect the functioning of the various systems of the body. During the first six to twelve weeks from injury i.e., the transitional phase between the absence and the gradual return of the sympathetic and spinal reflexes the functioning of the almost all systems of the body affected by the neurological impairment/loss undergo changes that necessitate close monitoring and recalibration of management of the various systems of the body to prevent complications, mitigate further impairment and minimize disability [21-25].

The reflex activity of the isolated spinal cord continues to vary throughout a patient's life with effect on the reflex functioning of the different systems of the body. A cold environment for example can increase reflex activity causing excess spasticity. Any pathology below the level of injury is likely to increase the afferent stimuli the spinal cord and result in excess reflex activity spasticity with implications on function of the various systems of the body. The sensory impairment or loss below the injury presents diagnostic challenges to the clinician. Conventional symptoms and signs of pathology are absent. This can result in delay of diagnosis with unpleasant consequences. Each system malfunction caused by spinal cord injury is a source of multiple disabilities and a potential source of a wide variety and range of complications. For example, impairment of bladder functions can result in urinary incontinence and urinary infections, calculi, renal damage, and renal failure.

Considering the number of disabilities and potential complications from the various system impairments, one can easily appreciate the magnitude of the burden to the patient, partner carers, and the team responsible for the treatment, rehabilitation, and education of the patient.

When a complication develops, the interruption of the higher

coordinating and moderating functions of the brain at the site of the spinal cord injury usually results in multiple and/or cascading intersystem effects that are rarely seen in other conditions. These are seldom easy to manage. For example, an anal fissure, while painless in a tetraplegic or high paraplegic patient can nevertheless cause excess spasticity which in turn may cause a fall and fracture of a long bone. Alternatively excess spasticity involving the pelvic floor muscles can result in urinary retention, autonomic dysreflexia and possibly some cerebra-vascular accident [26-30].

Unfortunately, Complications will invariably develop in Spinal Cord Injury patients if management is less than adequate. Pressure sores, respiratory infections, contractures of muscles are some such examples. Death and complications can also easily occur because of poor understanding of the physiology of the spinal man/woman. Death from respiratory failure in patients with injuries below C5, death from over hydration pulmonary embolism or from hypothermia during the stage of spinal shock, are examples of preventable complications which can lead to death.

Almost all complications following SCI are preventable or can be minimized. The non-medical effects of spinal cord injuries are equally devastating to patients and family members. It must be appreciated that the psychological, social, and medical effects of a spinal cord injury can easily affect each other's directly and/or indirectly.

For example, if a patient who is psychologically depressed or in a depressive mood to neglect pressure relief, this is likely to result in the development of one or more pressure sores, which may due to poor sight and smell cause social and matrimonial problems.

Fortunately, the incidence of traumatic spinal cord injury is the lowest of all major trauma. The incidence varies between countries ranging between 10-50 per million head of population per year. A general hospital serving a population of 250,000 is likely to receive three to twelve newly injured patients per year. With such relatively small numbers of patients it is rather difficult to develop the expertise of a multi-disciplinary team of health care professionals to manage such complex conditions in general hospitals. The management of SCI patients is therefore easier, safer and more cost effective to conduct in Spinal Injury Centres equipped with the infrastructure and expertise of adequately trained knowledgeable and competent health care professionals [31-35].

Furthermore, supervised peer support is easier to offer in Spinal injury centres where a large number of patients are treated. This is of incalculable value in the facilitation of management, psychological support and not infrequently vocational re engagement of the patient.

Principles of Active Physiological Conservative Management (APCM) of TSCI

It becomes readily evident to those who have been involved with the management of a SCI patient that the wide range of effects and the complexity of the condition require a team of clinicians from the medical and allied professions. It is essential that the members of such a team be knowledgeable about the condition, well trained, well-coordinated and prepared to provide a "Patient Centered Service" perhaps sacrificing in the process some of their

own "Professional & Personal Ambitions" [36-40].

The aims of Holistic Simultaneous APCM of all the effects of acute traumatic cord damage in Specialized Centres are to:

- Prevent death
- Mitigate the need for admission to Intensive Care and Ventilation of patients with a cord injury below C5 with no previous history of chronic respiratory problems and no life threatening associated injuries
- Contain the Biomechanical Instability of the injured spine until bony healing to ensure the shortest natural fusion that results in a painless full range of movement of the spine which is necessary for the patient to achieve maximum independence in and outside a wheelchair.
- Prevent and/or minimize complications to mitigate or minimize further impairment of body systems, minimize disability, and achieve maximum neurological recovery. This is achieved by constantly reviewing, monitoring, and recalibrating the management of the various systems of the body affected by the paralysis according to level of reflex activity and functioning until reflex activity returns and stabilizes.
- Frequently Monitor Neurology, Vital Capacity, Blood Pressure, Oximetry throughout the acute and subacute stages.
- Ensure by close monitoring that when patients are mobilized there is no neurological loss associated with a drop of Blood pressure, Vital Capacity or Low levels of Oxygen saturation.
- Manage to treat and retrain all the systems of the body to function safely and conveniently to patients and/or carers.
- Ensure a locomotor program of rehabilitation that maximizes independence within the level and density of cord damage and the disability.
- Equip the patient with adequate information about the

condition, self-care, self-confidence, and skills to re-engage socially.

- Assessing the patient's cognitive functions helps in the setting of goals of treatment, according to his/her capability in engaging in a demanding rehabilitation program as well as determine the extra need for care support or supervision.
- Assess the ability of the patient to resume previous employment.
- If necessary, ensure retraining the patient vocationally if unable to resume previous employment.
- Educate the patient in the condition as well as in the of prevention of complications prior to discharge to ensure maintenance of health and minimize need for re-hospitalization.
- Advise and assist in "Soft Landing" a healthy patient in own adapted environment.
- If your assessment determines that following discharge from hospital carers will be required by the patient, ensure they are well aware of the potential long-term complications and trained in the methods of their prevention.
- Maintain the health and independence of the patient following discharge by offering regular follow up reviews to detect and treat complications at an early stage and prior to the development of morbidity or mortality.
- Provide timely support during crises.

Such comprehensive management enables patients to live healthy, reasonably happy, productive lives as well as re-engage and compete in many spheres of life.

Because of the impaired physiology and/or sensory impairment/loss the principles of management of most conditions in TSCI patients differ from the principles of management of the same condition in neurologically intact individuals [41-45].

Conclusion

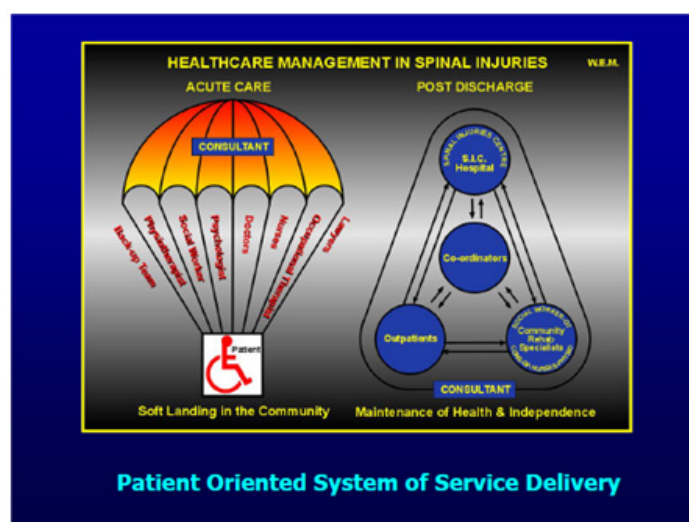


Figure 1: Model of Comprehensive System of Management of TSCI.

A Comprehensive, Patient Centered, Goal Oriented, Well Coordinated Service in the acute, subacute and rehabilitation stages together with an Ongoing Surveillance Service by the team that has provided the initial management and is familiar to the patient is paramount to enable individuals with TSCI to readjust, cope, regain self-confidence and control, engage, participate, contribute and compete in many spheres of life as well as remain healthy and out of hospitals for most of their remaining lives (Figure 1).

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Conflict of Interest

No conflict of interest.

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