

"Predictors of Neurological and Functional Recovery following Acute Traumatic Spinal Cord Injuries"

Historical

Before the 2nd World War the majority of patients with acute traumatic spinal cord injuries died before reaching the hospital or not long after in hospital. However for many decades before WWII there was no shortage of Physicians and Surgeons experimenting with the management of the injured spine. During the 2nd World War Sir Ludwig Guttman an Experienced Neurosurgeon developed a **Holistic Model of Service Delivery** based on Principles of Management specific to Acute Traumatic spinal Cord and Cauda Equina injuries (ATSCCEI) patients in Stoke Mandeville Hospital (SMH) . This transformed the outcomes of management from an assured death to survival and contribution of patients to their community. Within four years of the development of the Centre Guttman developed the SM Sports Centre for patients to compete in sports. The outcomes of this Model of Service Delivery, its methods of management and its low cost became the envy of the World. Centers delivering the same Model and Methods of Management developed in the UK and throughout most countries the World.

Management consisted of the simultaneous treatment of: the injured spine, the medical treatment and rehabilitation of each and every system of the body affected by the neural loss. The goal were: To achieve maximum neurological recovery, prevent the wide range of preventable complications, to train every system of the body to function as safely and as conveniently to the individual patient, to provide the psychological and practical support to patients from the early hours or days of injury.

Patients' cooperation in the physically, emotionally and psychologically demanding treatment help them achieve maximum independence, prevent avoidable complications, undergo vocational retraining, regain self-confidence to meet the range of challenges they have to face in the community and live long healthy dignified productive and often competitive lives. Such management necessitated a period of bed rest until the autonomic and somatic reflexes have fully returned. The long survival of patients enabled clinicians and scientists to study the condition as well as the neurological outcome in more depth in the short, medium and long term.

Characteristics of Patients with ATCSCI

The incidence of Acute Traumatic spinal cord injuries ATSCCEI is small ranging between 10-50/million of population/year. The effects of ATSCCEI are however devastating and life-changing medically, physically, psychologically, socially, financially, vocationally, environmentally, sexually & matrimonially. The combination of consequent Multi-System Physiological Impairment and Malfunction is not only responsible for a wide range of disabilities but also renders the patient at risk of a wide range of potential complications, morbidity and death. Patients are particularly vulnerable in the acute stage following the injury and during the transition between the stage of Spinal & Autonomic Shock and the return of these reflexes. The sensory impairment/loss prevents patients from exhibiting the expected symptoms and signs of complications. This results in delayed diagnosis and treatment of complications leading to increased morbidity and mortality. The principles of management of some of these complications in the presence of autonomic, sensory and motor loss are often different from the principles of management of the same complications in neurologically intact patients

The combination of a small number of patients, diagnostic difficulties, impaired physiology of the various Systems of the body, multiple system malfunction, multiple disabilities, dynamics between the psychological social and medical effects of neural tissue damage necessitates the provision of management by a Multidisciplinary team of trained and experienced Health Care Professionals. It is paramount that all the members of this team are familiar with all aspects of the condition, are able to ensure simultaneous attention of all the effects of neural tissue damage, are fully familiar with the expected good outcomes of a coordinated and fit for purpose holistic method of management. Good outcomes have consistently been documented for many decades when patients have been managed in well-resourced Centres that admit large number of patients soon after injury, provide the care and take responsibility for their short, medium and long term outcomes.

Methods of Management of Patients with Spinal Injuries and neurological damage

Despite his holistic methods of management of patients with Spinal Injuries and Neurological damage Guttman was disappointed with the poor neurological and other neurological and non-neurological outcomes of a mechanical approach to the management of the injured spine by Surgical Decompression and/or Stabilisation. Furthermore he observed that further damage to neural tissue can be caused by non-mechanical systemic complications such as severe hypoxia, hypotension, generalised sepsis, severe electrolyte imbalance and hypothermia can also damage the neural tissue non-mechanically and that patients are at a higher risk of developing these complications following surgery. He opted to manage by what I have subsequently described as simultaneous Active Physiological Conservative Management (APCM) of the injured spine and the effects of cord damage. This is essential to prevent both mechanical and non-mechanical damage of the physiologically unstable, injured and vulnerable spinal cord. Medical Management consisted of: an attempt to reduce malalignment of the injured spine ensuring an adequate containment of the Biomechanical Instability of at the site of injury by non-surgical means until bony healing occurs and the autonomic and spinal reflexes have returned. During this period clinical management ensures that systemic complications that can further damage the injured neural tissues are prevented or diagnosed and treated before morbidity, mortality and further neurological loss occur.

Neurological Outcomes

In the mid-1960s Frankel and his colleagues at Stoke Mandeville Hospital (SMH) observed that patients admitted within the first 14 days of injury with sensory sparing but no motor sparing at and/or below the level of the neural damage and treated with APCM made a significant motor and functional recovery. Over 60% of these patients were able to stand or walk with or without support +/- orthosis while over 70% of those who were admitted with sensory and any motor sparing (however weak the motor sparing is) did recover to stand or walk with or without support +/- orthosis. Frankel and his colleagues studied the neurology of 612 consecutive patients on admission and on discharge. The neurological examination was documented based on the guidelines of the Medical Research Council (MRC) All patients were admitted to SMH within 14 days of injury and both their injured spine and the effects of neural damage were treated with APCM (holistically and Conservatively). They classified the injury based on the sparing of the sensation as well as the functional usefulness of the spared motor power on admission and on discharge. Surprisingly they found that neither

the neurology of the patient on admission nor the neurological and functional recovery on discharge correlated with the radiological appearances of the spinal injury. Moreover the recovery was maintained on discharge and in the long term. The observations made by Frankel et al as well as the reliability, stability and reproducibility of the Frankel Classification and the predictability of the outcomes have been confirmed for more than five decades by many groups in the UK, and many groups of experts in the field overseas.

The Frankel Classification

The Frankel et al Classification of patients on admission and on discharge was published in 1969.

Development in management of the injured spine

The development of CT Scan, MRI, safer Anaesthesia and a wide range of instrumentation has encouraged Spinal Orthopaedic Surgeons and Neurosurgeons to adopt a different approach to the management of the spinal injury with an almost routine Surgical Stabilisation with or without Surgical Decompression. This based on the belief that they can obtain better outcomes can be reduced by early or late decompression of the neural tissue and reduction of the cost of management of patients can be reduced by early Surgical Stabilisation, Completion of Rehabilitation and discharge of patients . Unfortunately surgery is often carried out in isolation of the management of the medical and non-medical effects of the injured spine. This approach often results in a high risk of complications as well as potential mechanical and non-mechanical damage of the injured neural tissue. To date there is no adequate studies to offer evidence of equality of superiority of outcomes between any Surgical Procedure over the neurological or non-neurological outcomes of APCM

I will discuss the pitfalls in management and mechanisms of potential further damage to neural tissues with the various models of service delivery and methods of management and demonstrate that the neurological outcomes of ATSCCEI depend on both the model of Service Delivery, the Method of Management of the Injured Spine as well as the Expertise of those who provide the care to Patients

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