SUMMARY

The spine is a dynamic system composed of motion segments and having 4 major functions: support, mobility, housing, and control, thus supporting the mass of the body and withstanding external forces. At the same time it allows for mobility and enough flexibility to absorb energy and to protect against impact acting in harmony with the trunk muscle; and ligaments, acting on individual vertebra, providing postural control and spinal stability.

The spine is a flexible column with a multicurved shape, those curves occur in the sagittal plane, are closely related to displacement of the center of gravity with attaining the erect position, and is important in absorbing energy.

The motion segment is the elementary functional unit of the spine and is composed of the bony elements of two successive vertebrae with the ligamentous structures connecting them along with the intervening intervertebral disc.

Spinal biomechanics is that branch of study, which utilizes mechanical principles to investigate the properties of the spine. It is also concerned in the studying of the consequences of the application of external forces to the spinal column. Such forces may be normal (i.e. physiological) or pathological. Both may be injurious to the structure and functional relationships of spinal elements and thus may be associated with both degenerative disorders and trauma.

The function of the spine is primarily biomechanical; that is, it is involved in the transference of loads placed on the head, trunk, and extremities, and it acts as a protective armor for the spinal cord. While doing this, it must permit sufficient motion to take place between its members to allow physiologic movements of the body parts while maintaining an alignment consistent with its role as protector of the cord.

The motions that the spine is capable of undergoing under normal physiologic loads are determined by both the anatomic geometry of the osseous and ligamentous structures and the mechanical properties of these structures. A useful concept in describing spinal motion is degrees of freedom, which refers to the number of unique independent motions that one vertebra can have with respect to another.

Thoracolumbar fractures can result from either direct or indirect trauma. Direct trauma results in injury in the same site of its application. This kind of trauma includes stab wounds, missiles or other similar objects. Bony injury is usually stable but neurologic injuries are usually common and severe due to direct affection of the dura, cord & nerve roots. Indirect trauma produce injury some distances away from point of application of the trauma. Indirect trauma is far more common in civil life than direct trauma, and they produce unstable fractures more common than them too. Indirect trauma include muscular violence, excessive bending or the spine and excessive loading of the spine. Because the spine can move along 3 spatial axes namely X, Y and Z ,traumatizing forces are just excessive movement along the same axes.

Flexion, extension, rotation, compression, distraction, or shear forces in isolation or in combination may produce fractures of the thoracolumbar spine.

Treatment of thoracolumbar fractures is guided by the use of classification systems that detail the mechanisms of injury the effects on compromised spinal structures, and the potential for late mechanical instability or neural injury.

Thoracolumbar injuries were divided into minor and major injuries. Minor injuries, which accounted for over 15% of fractures, included fractures of the spinous and transverse processes, the pars interarticularis and the facet articulations. While major spinal injuries were divided into compression fractures, burst fractures, seat-belt injuries, and fracture-dislocations.

One of the most important initial responsibilities of the examining physician in evaluating the patient with spinal cord injury is to distinguish between complete and incomplete nerologic deficits. An incomplete neurologic deficit has a good prognosis for at least some functional motor recovery, whereas functional motor recovery is seen in only 3% of complete injuries in the first 24hours and virtually never after 24 to 48 hours. The incomplete deficit is evidenced by one of several patterns of partial neurologic function.

The radiographic evaluation of patients with suspected thoracic or lumbar fractures is initiated by obtaining standard anteroposterior and lateral radiographs of the throacolumbar spine. The goal of radiography in the injured patients is to obtain high quality, diagnostic images without

moving the patients inappropriately or placing the patient at any neurologic risk.

High-quality anteroposterior and lateral views of the spine permit primary evaluation and classification of deformities in the sagittal and coronal planes. CT identifies compromise to the middle column canal compromise, and fractures of the posterior elements not obvious on lateral films. Myelography is a valuable tool when neurologic insult is inconsistent with the level of vertebral injury, but its facility in the acute setting is limited. MRI is complementary to C.T scanning & better demonstrates soft tissue structures.

Initial management of the thoracic, thoracolumbar and lumbar spine-injured patients begins in the accident scene, with the treatment of life threatening injuries and the suspicion of a spinal cord injury in any multiply injured patients. A cervical collar and backboard should be used for expeditious transportation of the patient to a trauma center. Improved training of paramedical personnel and great attention to immobilization have resulted in a significant reduction of complete spinal cord injuries over the last two decades. Accident scene investigation and injury mechanism reconstruction can often aid in determining whether the victim is at risk for spinal column injury.

The stability of the injured spine, measured by its ability to withstand loads without causing the progression of a deformity at the injury site, is a primary biomechanical concern in the treatment of thoracolumbar injuries. Fractures that are considered stable are usually treated nonoperatively with an orthosis, while surgical reduction and stabilization may be indicated in those fractures that are considered

unstable. However, there exists a gray zone where in there appears to be considerable controversy in deciding which fractures may have enough inherent stability to be treated nonoperatively and which need surgical stabilization. Although several clinical studies have compared operative as well as nonoperative treatment of burst fractures and fracture dislocation; the choice of treatment modality in many cases has remained controversial. The goal of any treatment of thoracolumbar fractures, being operative or nonoperative, is to restore adequate stability to the injured spine so that the patient can be mobilized early without the risk of neurologic deficit.

Operative treatment of thoracolumbar injuries has become increasingly important in recent years. The range of surgical methods, with their different ways of approach, grafts and techniques, however, remains wide.

The results concerning the operative technique for the most frequently used procedure, posterior instrumentation with a transpedicularly fixed implant, are presented. Typical sources of error and possible complications during operations addressing the thoracolumbar spine can be divided according addressing the thorcolumbar spine can be divided according to the individual steps of the operation: Mistakes at positioning and closed reduction of fractures, approach-related complications, mistakes regarding the decompression of the spinal canal, complications related to instrumentation and stabilization and complications related to intervertebral fusion.

Management of the spinal cord injured patients requires specialized knowledge beyond the scope of any single physician, so that a team effort is required, regardless of the specialty of the primary managing physician.

The medical members of the team include the neurosurgeon, orthopedic surgeons, neurologist, urologist, psychiatrist and physiatrist. Further help is needed from paramedical personnel- physical and occupational therapists, social workers psychologist and vocational counselors and trainers who should work under the direction on of the physician or rehabilitation team throughout the patient's rehabilitation, including out-patient follow up.

An excellent environment for such management is the spinal cord injury center, where patients can be treated from the day of injury to the ultimate vocational rehabilitation.