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م. Ahmed Mamdouh Ahmed Sallam

Dedications

To my Mother, And All my Family

✍. Ahmed Mamdouh Ahmed Sallam


وأنزل الله عليك
الكتاب والحكمة
وعلَّمَكَ مَا لَمْ تَكُن
تَعْلَمُ وكَانَ فَضْلُ
اللَّهِ عَلَيْكَ عَظِيماً
صدق الله العظيم
سورة النساء الآية
(113)

INTRODUCTION

Thoracic and lumbar fractures are highly prevalent, representing nearly 90% of all traumatic spine injuries. Thoracolumbar fractures occur when the vertebra is subjected to a significant axial and possibly flexion force vector that brings about the failure of the anterior vertebral body in compression. This region is uniquely susceptible to this mechanism of injury as a result of its location between the stiff, kyphotic thoracic spine and the more mobile, lordotic lumbar region (Patel et al. 2010).

Clinical stability of the spine is defined as the ability of the spine under physiologic loads to limit patterns of displacement so as not to damage or irritate the spinal cord or nerve roots and, in addition, to prevent incapacitating deformity or pain caused by structural changes whereas instability is inability to limit excessive or abnormal displacement (Whitesides 1997).

The successful diagnosis and management of thoracolumbar instability is dependent on an accurate assessment of spinal stability, a concept defined by the integrity of the spine and its supporting structures as well as the neurologic status of the patient (Vaccaro et al. 2005).

One true indication for surgical intervention is the presence of progressive neurological deterioration in the presence of spinal cord compression. When direct spinal canal decompression is promptly performed, neurological recovery has been observed. The correlation between spinal canal stenosis and neurological deficit remains controversial. Some suggest that the presence of bony fragment in the canal adds to the neurological trauma and may be responsible for the persistent deficit. Others report no correlation between canal narrowing and neurological deficit (Mohanty et al. 2008).

The management of thoracolumbar spine instability remains controversial in spite of an improved knowledge of the morphometric, anatomic and biomechanical features of thoracolumbar vertebrae (Yung et al. 2011).

The location of the instability can influence the surgeon's choice of fusion. A long fusion in the upper and middle thoracic spine does not reduce very much patient's spinal mobility and function. However, the thoracolumbar and lumbar spines are functionally very important. Preservation of mobility in these segments of the spinal column is fundamental particularly in manual workers whose jobs require increase demands on the spine (Briem et al. 2010).

Many instability definition schemes use point systems to quantitate the extent of spinal integrity and to ultimately

determine the presence or absence of spinal stability. Denis's three column system is more applicable because it is not only assist in assessing the bony collapse associated with axial load-bearing, but also offer insight into the assessment of the distraction, flexion, and extension components of the injury of spinal element. Denis's three column theory, which adds the concept of the middle column, allows specific assessment of that component of the spinal column in the region of the neural axis (Denis 1999).

Pedicle screw fixation is relatively safe procedure, which achieves reduction and stability and provides early pain relief and mobility (Riaz ur et al. 2011). Long segment fusion (fixing two or more levels above and below a fractured vertebra) is stronger and stiffer than Short Segment fixation (instrumentation one level above and below a fractured vertebra); however it sacrifices spinal motion (Dashti et al. 2008).

Posterior transpedicular stabilization is used for traumatic, degenerative, neoplastic, infectious, and malformative pathologies associated with axial instability. Despite technical advances over the last few decades, pedicle screw insertion is still associated with a risk of complications (Gautschi et al. 2011). Among them, the most commonly reported complication is screw malpositioning, with an overall incidence of 0%–42% in the literature (Chipman et al. 2009).

As a simple and commonly used technique, short-segment pedicle instrumentation of thoracolumbar instability seems to have a high rate of implant failure and recurrence of instability. Insertions of pedicle screws at the fracture site or transpedicular intra-corporeal bone cement injection were used in the past in order to prevent the early failure and increase the biomechanical stability of the construct (Been et al. 1999).

In the literature there are biomechanical studies aimed to determine the effect of adding pedicle screws at the level of a burst fracture (Toyone et al. 2006). Data obtained from those studies suggest that the use of transpedicular screws at the fractured level provides the advantages of a stiffer construct, an increased biomechanical stability and the effect of 3-point fixation of the unstable segment leads to gardening against pulled-out (Anekstein et al. 2007). Decreased flexibility of a short segment construct providing less motion at the unstable segment is supposed to be another advantage via intermediate screws (Onat Uzumcugil et al. 2010).

Currently short-segment pedicle instrumentation for thoracolumbar fractures is gaining in popularity. Otherwise, long-segment fixation may be chosen as an another treatment method (Yu et al. 2010).

AIM OF THE WORK

The aim of this study is to evaluate the clinical and radiological outcome of short segment versus long segment posterior stabilization using transpedicular screws for management of thoracolumbar spine fracture instability.

HISTORY AND EPIDEMIOLOGY

History of spinal injury:

Treatment of traumatic spinal injuries was first recorded by Hippocrates (460-370 BC) who used traction devices to obtain spinal reduction and advocated external stabilization and immobilization fig. (1) (Goodrich 2004).

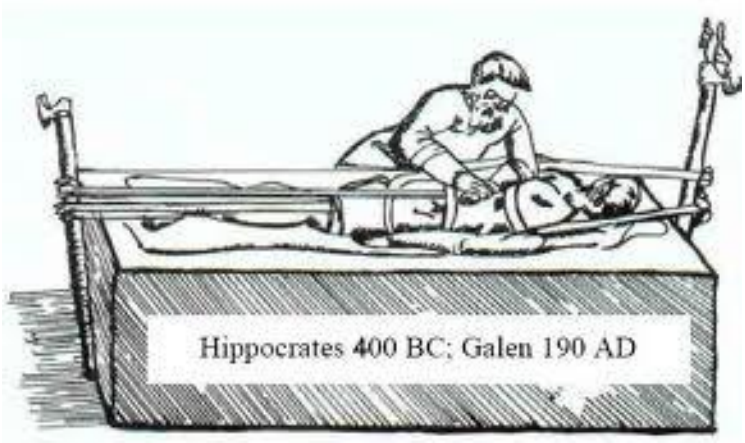

Fig. (1): Hippocrates external stabilization and immobilization 400 B.C *(History of spine surgery in the ancient and medieval worlds.* Neurosurg Focus, 2004. **16**(1): p. E2)

Surgical decompression for the treatment of traumatic spinal cord injury was initially popularized by Paulus of Aegina (625-690 CE) but was not universally accepted because of very poor surgical outcomes at the time. In 1646, Fabricius Hildanus performed the first documented open reduction of a spinal fracture(Singh et al. 2004).

Before the development of spinal instrumentation, there was a bias toward conservative treatment, which often involved long periods of immobilization (4 to 8 weeks commonly) typically with traction to restore the spinal alignment and allow the fractures time to heal. These long periods of immobilization were associated with significant medical complications including pneumonia, deep vein thrombosis, and decubitus ulcers (Kose et al. 2014).

The use of spinal instrumentation provided surgeons the ability to restore immediate stability to the spinal column, thus allowing for earlier mobilization and fewer complications from prolonged immobilization. In addition, spinal instrumentation theoretically improved fusion rates by providing a stable environment of bone healing, thus reducing the risks of late neurologic deterioration due to spinal instability, progressive spinal deformity, and associated axial back pain syndromes (Verlaan et al. 2013).

Even with improvements in instrumentation, it was realized that all instrumentation will fail eventually unless a bony fusion is achieved and, therefore, arthrodesis remains a critical part of all spinal stabilization surgeries (Norton et al. 2014).

Epidemiology of thoracolumbar spine injury:

Systematic epidemiologic data on traumatic thoracolumbar fractures are rare and differ depending on the area studied and on the treating center (Hee et al. 2007).

The studies available from western countries reveal typical and comparable data on incidence, localization, and mechanisms of injury. Thoracolumbar fractures are more frequent in men (2/3) than in women (1/3) and peak between the ages of 20 and 40 years (Marco et al. 2009).

Approximately, 160000 patients /year sustain an injury of the spinal column in the United States. The majority of these injuries comprise cervical and lumbar (L3–L5) spine fractures. However, between 15%and 20%of traumatic fractures occur at the thoracolumbar junction (T10–L2), whereas 9–16% occur in the thoracic spine (T1–T9) (Bakhsheshian et al. 2014).

About 50–60% of thoracolumbar fractures affect the transition T10–L2, 25–40% the thoracic spine and 10–14% the lower lumbar spine and sacrum (Van Herck et al. 2009).

In a study by Magerl and Engelhardt on 1446 thoracolumbar fractures, most injuries concerned the first lumbar vertebra, i.e., 28% (n=402), followed by T12 (17%, n=246) and L2 (14%, n=208). The epidemiologic multicenter study on