KASR ALAINY

Postoperative C.T. Assessment with Clinical Correlation of Accuracy of Lumbar Pedicle Screw Insertion

Thesis submitted in partial fulfillment of the master degree
(M.Sc.) in neurosurgery

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Abstract

The objective of this study is to evaluate the incidence of lumbar pedicle screw misplacement whether open or percutaneous by postoperative CT scan and to correlate misplaced screws to the onset of clinical symptoms related to malposition if any.

Key Words: Pedicle screw, Misplacement, Fusion, Computed tomography

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Introduction

Pedicle screw instrumentation is widely used in the lumbar spine as a means of stabilization to enhance arthrodesis. Indications for pedicle screw instrumentation include stabilization in the setting of trauma, deformity, tumors, infections, degenerative conditions and reconstruction. Since the introduction of pedicle screws, accuracy of placement has been the subject of many studies, in which a wide range of screw malposition rates have been reported (***Albert et al, 2004)***

The main problem at surgery is that a blind technique is used; the surgeon does not see the pedicle ***(Castro et al, 1996).***

The risk of iatrogenic injury must be minimized as vital anatomic structures surround the pedicle: the dural sac medially, the nerve roots superiorly and inferiorly, and the vascular structures anterolaterally. Further, the accuracy of pedicle screw insertion is crucial for the efficiency and stability of the surgical procedure ***(*Albertet *al, 2004).***

For accuracy, pedicle screw instrumentation may be guided by anatomic landmarks, preoperative imaging, and intraoperative imaging tools such as plain radiography, fluoroscopy, and, more recently, image-guided technology ***(Akyildiz et al, 2005).***

The development of instrumentation techniques to stabilize and correct the injured or diseased thoracolumbar and lumbar spine has made enormous progress during recent years. Researchers have reported that transpedicular screw fixation is superior to anterior instrumentation and posterior hook-rod fixation because the pedicle offers a strong point of attachment ***(Akyildiz et al, 2005).***

Pedicle screw placement does not pose the same high risk of damage to the spinal cord, dural sac, and nerve roots in the lumbar region as it does in thoracic and cervical spine. However, accurate anatomic knowledge is needed to perform a safe surgical intervention in the lumbar region (***Attar et al,2001).***

Frequently during the postoperative period, a surgeon must evaluate new complaints of pain or new neurological deficit. With the use of a pedicle screw system, it becomes imperative that a causal relation between the screws and neurological complication be ruled out ***(Yoo et al, 1997)***

Concerns regarding safety, potential complications if screws are misplaced, and loss of mechanical advantage with pedicle wall disruption, have focused attention on screw placement techniques ***(Robertson et al, 2000)***

The rate of misplaced screws still may be considerable and has been reported to range up to nearly 40% ***(Grauer et al, 2004)*** Many more misplacements occurred but went unobserved ***(Glossop et al, 1996).*** In a review of the literature, noted a 28.1% to 39.9% pedicle screw malposition rate in clinical studies and a 5.5% to 31.3% malposition rate in cadaver studies.

The percentage of malpositioned screws may be higher when normal anatomic landmarks have been obscured, as with revision surgery in the setting of a posterolateral fusion ***(Austin et al, 2002).***

Although neurological deficits related to screw misplacement are less common, asymptomatic violations of the cortical bone can result in a weakened biomechanical construct. These risks are amplified in the thoracic spine, where the spinal cord is in closer proximity and pedicle size is reduced ***(Wang et al, 2004).*** Intraoperative fluoroscopy and serial radiography only demonstrate the depth of screw penetration but cannot be used to recognize screw malpositioning ***(Açikbas et al, 2000).*** The gold standard for detecting pedicle screw penetration in cadaveric studies has been direct observation at dissection ***(Grauer et al, 2004)***.

Although it is generally believed that CT imaging is more accurate than conventional radiography in determining pedicle screw location, particularly in

the setting of medial and lateral pedicle perforation, a range of accuracies for both radiographic and CT assessed perforations has been reported ***(Ahlgren et al,2004).*** However, no clear data currently exist on the sensitivity or the specificity of using CT images in identification of pedicle screw placement ***(Yoo et al, 1997)***.

Aim of work

1. Review of literature and recent publications regarding the lumbar spine anatomy, indications of pedicle screw insertion, surgical techniques of insertion of pedicle screws, the reported incidence of screw misplacement and other complications.

2. Evaluation of the accuracy of pedicle screw placement and the results of different techniques of surgery through a study done on 50 patients of both sexes and different ages reviewed for preoperative clinical symptoms and preoperative radiology including MRI and Plain x-rays and methods used for fixation. The patients will be evaluated by C.T. Scan with 2 mm axial slices with bone window will be performed in all cases to evaluate implant position after surgery and Correlation between clinical symptoms and radiological violation will be reported.

3. Analysis of data and results.

4. Discussion and conclusion.