

# The results of transpedicular fixation of unstable thoracolumbar vertebral fractures

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## ÖZET:

*Nisan-1990 ve Mayıs-1997 tarihleri arasında 101 hastanın vertebra kırıkları cerrahi olarak tedavi edildi. Ortalama takip süresi 27 ay idi. Yetmiş erkek ve 31 bayan hastanın ortalama yaşı 35.9 olarak bulundu. En sık birinci lomber vertebra etkilenmişti. 94 burst kırığı, 22 kompresyon kırığı, 4 kırıklı-çıkık ve 1 emniyet kemeri yaralanması tespit edildi. Nörolojik durum, 59 hastada Frankel-E, 14 hastada Frankel-A düzeyindeydi. Ortalama lokal kifoz açısı 24 derece ve anterior kompresyon yüzdesi %40.7 idi. Ortalama spinal kanal tutulumu %44.5 olarak bulundu. Ameliyatlar ortalama dörtbuçuk gün içinde yapıldı. Ameliyat sonrası tüm hastalarda korse kullanıldı. Komplikasyonlar; bir hastada serebrospinal sıvı fistülü, iki yüzeysel enfeksiyon ve bir bası yarası olarak gözlemlendi. Nörolojik kaybı olan onsekiz hasta kısmi olarak, iki hasta ise tam olarak düzeldi. Bu kırıkların tespitinde 394 transpediküler vida kullanıldı. Otuzbir vida eğilmesi, 9 vida kırılması ve 19 vida yer değiştirmesi tespit edildi. Transpediküler fiksasyon torakolumbar vertebra kırık cerrahisinde etkili bir tedavi yöntemi olarak bulundu.*

*Sonuç olarak, iyi seçilmiş vakalarda vertebra kırıklarının posterior yaklaşımla cerrahi tedavisi, komplikasyonları olmakla birlikte etkili bir tedavi metodu olarak bulundu.*

**Anahtar Kelimeler:** Torakolomber vertebra kırığı, transpediküler fiksasyon.

## SUMMARY

*Between April 1990 and May 1997, 101 patients with unstable thoracolumbar vertebral fractures were treated operatively. The mean follow-up was 27 (3-66) months. There were 70 men and 31 women. The mean age was 35.9 (18-69) years. Etiology was falling from a height in most of them (56.4%). The delay from the original trauma to the presentation ranged from 2 hours to 7 days. First lumbar vertebra was affected mostly (35.5%). According to the Denis classification, there were 94 burst fractures, 22 compression fractures, 4 fracture-dislocations and one seat-belt injury. Fifty-nine patients had Frankel type E, and 14 had Frankel type A neurologic status. The medium angle of local kyphosis was 24° and the percentage of anterior compression was 40.7%. The percentage of average spinal canal involvement was 44.5%. The average time after the trauma till the operation was 4.5 days (6 hrs-20 days). The mean operative time was 135 minutes and 2.8 units of whole blood transfusion was used on the average, intraoperatively. Postoperative bracing was applied to all of the patients. One CSF fistula, two superficial infections and one pressure sore were noted as early complications. Eighteen patients with neurologic deficits had partial, and two patients had full recovery. 394 transpedicular screws were used and there were 31 (7.8%) bent screws, 9 (2.2%) screw breakages and 19 (4.8%) screw migrations. Transpedicular fixation was found to be an effective method for thoracolumbar vertebral fracture surgery.*

**Key Words:** Thoracolumbar spine fractures, transpedicular fixation.

Thoracolumbar vertebral fractures have important consequences on stability and balance. Treatment modalities have evolved considerably since the last 30 years. Consensus was obtained for the conservative treatment of stable fractures and that unstable fractures should be operated on (1-10). Operative intervention aims are, fracture reduction,

neural decompression, rigid fixation, early mobilisation and rehabilitation.

In this retrospective study, we present our results of vertebral fracture treatment by transpedicular fixation using screw-hook-rod combination which has currently become the most popular and effective method of treatment.

## MATERIALS AND METHODS

A hundred and one patients having unstable thoracolumbar fractures were treated operatively between April 1990 and May 1997. There were 70 (69.3%) men and 31(30.6%) women. The mean age was 35.9 (18-69)years. Etiology was falling from a height in 57(56.4%) (Table-1). First lumbar vertebra was affected the most (Table-2). Most of the fractures were of the burst type (77.6%) according to Denis' classification (Table-3). Fifty-nine (58.4%) of the patients had no neurologic impairment, whereas 14 (13.8%) of them had Frankel type-A neurologic deficit (Table-4). Delay from the onset of the trauma till the presentation was between 2 hours and 7 days. Twentyone of the patients had concomittant injuries. Thirteen (12.8%) patients had multilevel vertebral fractures. Local kyphosis angle was between 10°-50° (24°average) and anterior compression percentage averaged 40.7% (0-73%). Spinal canal in-

volvement was 44.5% on the average. The mean time interval until the operation was 4.5 days ( 6 hrs-20 days). The medium operative time was 135 minutes and an average of 2.8 units of whole blood transfusion was used intraoperatively. Transpedicular fixation and fusion were done for all the patients. Two patients had laminectomies in addition to the procedure.

"Alıcı" type implant system was used for 90 of the patients. Five 'fixateur interne', 4 TSRH, and 2 'İbni Sina' posterior system were used for the last. Iliac autogeneous bone graft was used for fusion after de-cortication for all the patients. Transpedicular screws and hooks were placed in the vertebra one level above and below the affected one. For multilevel fractures and paraplegic patients the instrumentation was made longer.

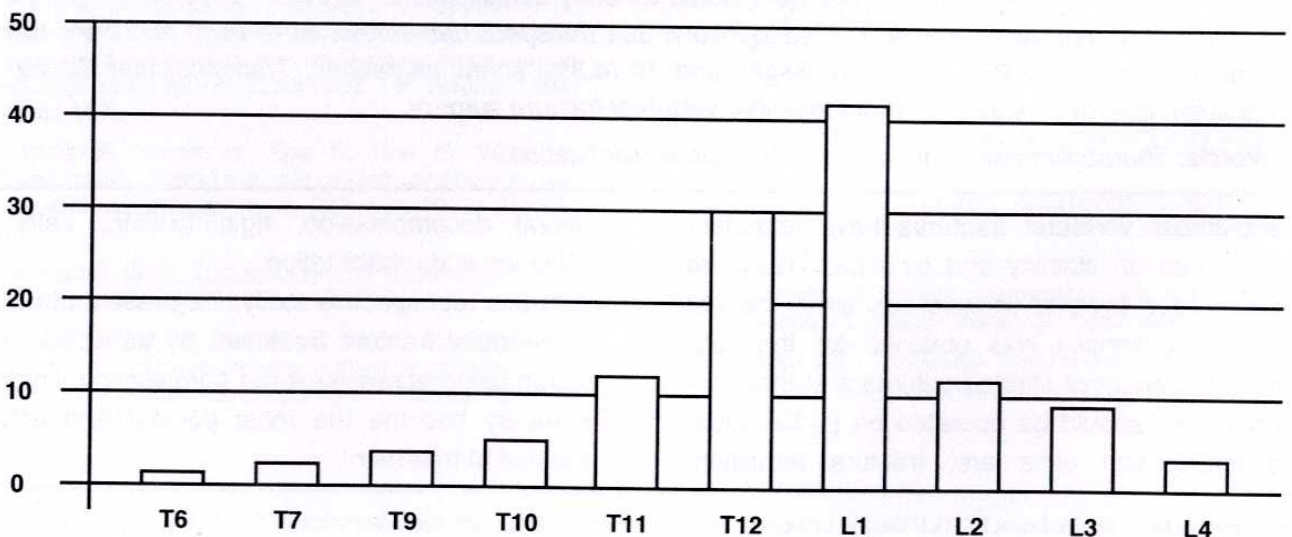
Postoperative antibiotic prophylaxis with a third generation cephalosporin was administered for 4 to 7 days. Mobilization in the bad was allowed after 2 days. All the patients but the ones with neurologic deficits were mobilized with a brace after 7-10 days. Patients who had neurologic deficits were subjected to a rehabilitation programme as soon as they were accepted into the clinic.

The mean follow-up period was found to be 27 months (3-66). Results were evaluated according to the recovery period, neurologic progress, and complications. Follow-ups were at 6th and 12th weeks and 6th, 12th, 18th and 24th months and annually thereafter.

**Table 1.** Distribution of fractures according to the etiology.

Mechanism	Number	%
Traffic Accident	35	34.6
Fall	57	56.4
Work Accident	9	8.9
<b>Total</b>	<b>101</b>	<b>100</b>

**Table 2.** Distribution of fractures according to vertebral level.



**Table 3.** Distribution of fractures according to Denis classification.

Fracture Type	Number	%
Burst	94	77.6
Compression	22	18.1
Fracture-Dislocation	4	3.3
Seat-Belt	1	0.8
<b>Total</b>	<b>101</b>	<b>100</b>

**RESULTS:****A-Clinical Assessment**

**Pain:** Twenty(19.8%) patients had mild, and 9 (8.9%) patients had moderate back pain. Seventytwo(71.2%) patients had no detectable complaint.

**Deformity:** According to the last follow-up records, 8(7.5%) patients had local kyphosis.

**Range of motion:** Excluding the patients who had Frankel type A, B and C neurologic deficits, 51 patients (62.9%) had normal back motion. Twentytwo patients (27.1%) had mild and 8 patients (9.9%) had moderate limitation of motion.

**Neurologic Status:** From 42 patients who had some degree of neurologic deficit, 28 had an average of 1.4 Frankel grade of improvement.

**B-Radiologic Assessment:**

**Local kyphosis angle and percentage of anterior compression** were evaluated on standard x-rays and obliteration of the spinal canal was assessed on CT images. (Fig.1a-f)

**Local kyphosis angle:** 12.4 degrees of average correction was obtained postoperatively. At the last follow up there was 4.1 degrees of average loss of correction.

**Anterior compression percentage:** The mean pre-operative value was 40.7%(0-73%) and %21 (0-50%) postoperatively. There was a mean loss of 6% correction at the last follow up.

**Spinal canal obliteration:** Spinal canal was obliterated 44.5% (30-80%) on the average, pre-operatively. Postoperative value was 35% (30-70%). At the last follow up it was not possible to have CT images.

**C-Complications:** One hundred and one patients were operated using 394 screws and 45 hooks. No

**Table 4.** Grading of neurologic deficit according to "Frankel" classification.

Neurologic deficit (Frankel type)	Number	%
A	14	13.8
B	2	1.8
C	4	3.3
D	22	18.1
E	59	58.4
<b>Total</b>	<b>101</b>	<b>100</b>

neurologic deficits were detected due to this process. However early postoperative X-rays revealed 12 (3%) screws entering the disk space.

There were 2 superficial and 1 deep infection in the early postoperative period. Appropriate antibiotherapy and wound care led to complete cure. One patient had respiratory and circulatory arrest at the 10th day which ended with decerebration. In another patient, CSF fistula developed. Two late deep infections at the 16th and 24th months subsided after removal of the implants and antibiotherapy.

Postoperative X-rays showed 31 (7.8%) bent screws, 9 (2.2%) broken screws and 19 (4.8%) screw migrations.

Eighteen of the implants were taken out after an average of 28 (11-38) months.

**Discussion**

There is a general agreement on the issue of surgical management of unstable compression and burst fractures as well as seat-belt and fracture-dislocation injuries (10-15). However, treatment of burst fractures without neurologic deficits are still controversial (12-17). Some of the authors advocate surgical treatment for burst fractures which has 40-50% loss of corpus height, local kyphosis angle over 30°, and spinal canal obliteration over 50% (18-21). Whereas others favor prophylactic stabilization for all burst fractures (3,12,13,19,20,22- 29).

Operative fixation of vertebral fractures provide early motion and rehabilitation, anatomic reduction and alignment of the vertebral column, and helps neurologic recovery (4,12,22,30). Transpedicular screw fixation is the end result of studies directed to this

task which had begun with the efforts of Harrington and continued until 1992 when, Magerly (8) devised a system of transpedicular screw and rod fixation which was further modified by Dick (31) in 1982. This system provides short segment fixation and fusion (3,22,23,29). Screws dominate all three columns of the vertebra. They can also be applied in cases of posterior vertebral defects (31,32). Local kyphosis and anterior corporal compression can effectively be corrected by using compression and distraction methods. We obtained 12.4° of average correction of local kyphosis. This value is in accordance with the studies of Aebi (3,22), Dick (17), Lindsey (24) and Sasso (10). However, we had more loss of correction which we attributed to implant failure, inappropriate application and uncooperative patients. Our values of loss of corpus height correlates well with the literature (9,22,33).

Prompt surgery and distraction decompresses the spinal canal successfully. Gartzbein et al (34) obtained 18% decompression in cases which were operated in 4 days. This value was lowered to 8% after the 4th day. 9.5% decompression which we obtained in our patients is not a desirable level. This must be the consequence of late surgery because of additional medical problems and difficulty in obtaining the implants.

Transpedicular screw fixations are usually made under scopy control (35). We had used anatomic landmarks to determine the loci of the pedicles and confirmed this with x-rays. We had 12 screws entering the disc space with this method but there was no neurologic affection.

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Screw breakage, bending and migration values correlate with the literature (3,22,27,33,35-38). It was observed that screw bending happened between the 1st and 3rd months. Thus we propose that bracing should be applied till the end of this period, when fusion becomes solid. Our value of postoperative infection (5.6%) was similar to the values in the literature (2-8). Late infection is rarely mentioned in the literature. Late deep infections were reported as 1% in Heggeness et al.'s (32) series and as 18% in Lifeso et al's (39) series. They appeared at the 16th and 24th months postoperatively.

Harrington rod and its modifications and transpedicular screw plate systems require long segment fusion and fixation. Rod long fuse short method involves multisegmental fixation but short segment fusion. Yet, this also is not an absolute solution, since it produces degenerative changes in facet joints. In transpedicular screw-rod systems, it is possible to make short segment fixation and fusion.

Catching the vertebra from its most strong part, the pedicle, and adding transvers connectors to the system provides three dimensional rigid fixation against flexion, extension and rotational forces. Loss of normal physiologic curves can be reconstituted by giving appropriate curves to the rods. Also effective distraction can be achieved that can reproduce the corpus height. However, if the vertebra does not have enough stock of bone, anterior instrumentation and fusion should be applied.

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