The results of transpedicular fixation of unstable thoracolumbar vertebral fractures

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ÖZET:

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

Anahtar Kelimeler: Torakolumber vertebral kırığı, transpediküler fiksayon.

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. Fiftynine 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). Fijyine (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 concomitant injuries. Thirteen (12.8%) patients had multilevel vertebral fractures. Local kyphosis angle was between $10^\circ$-$50^\circ$ (24°average) and anterior compression percentage averaged 40.7% (0-73%). Spinal canal involvement 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.

"Alci" type implant system was used for 90 of the patients. Five 'fixateur interne', 4 TSRH, and 2 'Ibni Sina' posterior system were used for the last. Iliac autogeneous bone graft was used for fusion after decortication 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 bed 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.

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Number</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Traffic Accident</td>
<td>35</td>
<td>34.6</td>
</tr>
<tr>
<td>Fall</td>
<td>57</td>
<td>56.4</td>
</tr>
<tr>
<td>Work Accident</td>
<td>9</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>101</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 2. Distribution of fractures according to vertebral level.
TABLE 3. Distribution of fractures according to Denis classification.

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burst</td>
<td>94</td>
<td>77.6</td>
</tr>
<tr>
<td>Compression</td>
<td>22</td>
<td>18.1</td>
</tr>
<tr>
<td>Fracture-Dislocation</td>
<td>4</td>
<td>3.3</td>
</tr>
<tr>
<td>Seat-Belt</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>101</td>
<td>100</td>
</tr>
</tbody>
</table>

RESULTS:
A-Clinical Assessment
Pain: Twenty (19.8%) patients had mild, and 9 (8.9%) patients had moderate back pain. Seventy-two (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. Twenty-two 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 preoperative 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, preoperatively. 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 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 antibiotic therapy 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 antibiotic therapy.
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, Meagerly (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 Aebe (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. Gartzein 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.

KAYNAKLAR


