

# THE CONSERVATIVE TREATMENT OF THORACOLUMBAR FRACTURES

## THE RESULTS OF FIVE YEARS FOLLOW-UP

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### ABSTRACT

We present in this study the late results of conservatively treated 456 thoracolumbar vertebra fractures in our clinic from 1986 to 1996. The mean age of the patients was 39.5 (9-82) years. 257 cases were followed for five years. Most of our patients had compression type fractures (n:388), followed by burst type fractures (n:102). The distribution of the burst fractures according to the Denis' classification was; superior end plate type 77, both end plate type 21, lateral deviation type 4.

The first aim in conservatively treated patients is to reduce the fracture and to hold it in an acceptable position by hyperextension posture. In most of our cases, we performed hyperextension cast brace. In some patients who were old and had osteoporotic fractures or minimal wedge fractures, we preferred thoracolumbosacral orthosis (TLSO) initially. In burst and compression fractures treated with hyperextension cast brace or TLSO, measured kyphosis angles before the treatment and at the last control were found significantly correlated ( $p<0.05$ ). In burst fractures, measured canal dimensions before the treatment and at the last control also were found significantly correlated ( $p<0.05$ ). We did not observe neurological impairment in any case treated conservatively.

Evident improvement in kyphosis angles, statistically correlated end results and less seen late complications proved that conservative treatment is a successful method in appropriate cases.

**Key words:** Thoracolumbar vertebra fractures, Conservative treatment, Hyperextension cast brace, Kyphosis angle.

### ÖZET

#### TORAKOLUMBAR KIRIKLARIN KONSERVATİF TEDAVİSİ - 5 YILLIK İZLEM SONUÇLARI

Bu makalede, 1986 - 1996 yılları arasında konservatif tedavi edilen 456 torakolumbar vertebra kırığı olgusunun geç sonuçlarını sunuyoruz. Olguların yaş ortalaması 39.5 (9-82) olup 257 olgu, 5 yıl izlenmiştir.

Çoğu olguda (388 olgu), kompresyon tipi kırık varken, bunları patlama tipi kırıklar (102 olgu) izlemektedir. Denis sınıflamasına göre patlama kırıklarının dağılımı, üst uç plak tipi 77, her iki uç plak tipi 21, lateral deviasyon tipi 4 olgu şeklindeydi. Konservatif tedavi edilen hastalarda ilk amaç, kırığı redükte etmek ve hiperekstansiyon postürü ile kabul edilebilir pozisyonda tutmaktır. Çoğu olgumuzda, hiperekstansiyon alçı breysi uyguladık. Yaşlı ve osteoporotik veya minimal kama kırığı bulunan bazı olgularda, başlangıçta torakolumbosakral ortez (TLSO) tercih ettik. Hiperekstansiyon alçı breysi veya TLSO ile tedavi edilen patlama ve kompresyon kırıklarında, tedavi öncesi ve son kontrolde ölçülen kifoz açıları, önemli ölçüde korele bulundu ( $p<0.05$ ). Patlama kırıklarında, tedavi öncesi ve son kontrolde ölçülen kanal genişlikleri de önemli korelasyon gösterdi ( $p<0.05$ ). Konservatif tedavi edilen hiçbir olguda, nörolojik kötüleşme izlenmedi.

Kifoz açısındaki belirgin düzelme, istatistiksel olarak korele olan sonuçlar ve geç komplikasyonların çok az görülmesi, uygun olgularda, konservatif tedavinin başarısını kanıtlamaktadır.

**Anahtar sözcükler :** Torakolumbar vertebra kırıkları, Konservatif tedavi, Hiperektansiyon alçı korsesi, Kifoz açısı.

### INTRODUCTION

Thoracolumbar vertebra fractures persist as a serious problem, especially in the industrial and developing countries. This problem has gained further importance with the wars for last fifty years. Spinal cord injuries accompanying thoracolumbar fractures may cause important mortality and morbidity problems. Fractures without spinal cord injury, unless well-treated, also become

another serious problem for those young and active patients, cause late complications such as chronic back pain and persistent spinal deformities.

Traffic accidents and falls from height are the major causes of thoracolumbar vertebra fractures. Falling from height seems more often in the younger (0-15 years old) and older (over 75 years old) age groups. Especially in the latter group, falls make 60% of all cases.

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Stability is an important factor while planning the treatment. Generally accepted opinion is to treat the unstable fractures surgically and the stable ones conservatively. Even an unstable fracture can be treated conservatively if the effecting loads are decreased by the bed rest.

To define the term of stability correctly gains importance in this situation. Stability is defined as the fracture fragments to be in an acceptable position or reducible by closed methods after initial trauma and be stable afterwards.

Knight notifies the following properties to select conservative treatment candidates: no neurological impairment, no more anterior height loss than 20%, no more kyphosis angle than 20 degrees, canal narrowing under 20%, single level fractures, non polytraumatized patients.

There are many articles about the prognosis of fragments in the spinal canal after burst fractures. Some authors, depending on late term CT studies, defend that fragments in the spinal canal can not be a surgical indication unless there is initial neurological damage, because of late spontaneous resorbtion and canal remodeling (11,19).

**PATIENTS AND METHODS**

We present in this study the late results of conservatively treated 456 thoracolumbar vertebra fractures in our clinic from 1986 to 1996 (Figure 1). 178

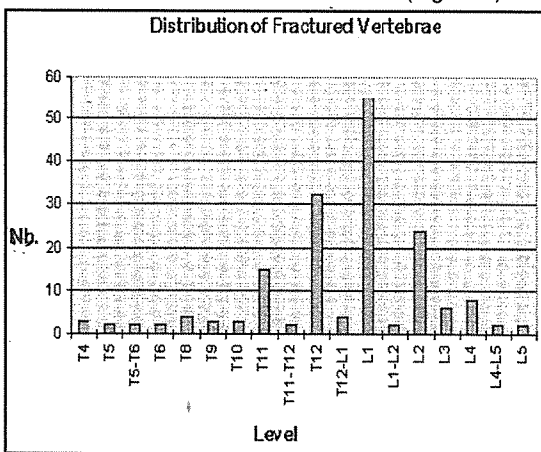


Figure 1. Distribution of Levels

of the cases were female and 278 were male. Female to male ratio was 1:1.5. Minimum age was 9, maximum age was 82 and the mean age was 39.5.

Most of the cases (42%) were in the 20-40 age group. 257 of all cases could be followed for five years.

The causes of fractures were: traffic accidents (46%), falls from height (36%), simple falls (13%) and direct trauma (5%).

Most of our patients had compression type fractures (n=388), followed by burst type fractures (n=102). The distribution of the burst fractures according to the Denis' classification was; superior end plate type (77), both end plate type (21), lateral deviation type (4). There were also 4 flexion-distraction type, 2 flexion-rotation type and 2 Chance fractures in the series.

The first aim in conservatively treated patients is to reduce the fracture and to hold it in the acceptable position by hyperextension posture (18).

We performed hyperextension cast brace in 48% of our cases. After casting, control x-ray films were taken and the patient was discharged after a day of follow-up. The bed rest period at home was 6-8 weeks in the cast brace without sitting and standing. At the end of this period, control x-ray films also were taken and the cast brace was removed. After removal of the cast brace, the patients were mobilized with a flexible TLSO for 4-6 weeks.

We preferred TLSO initially in 41% of patients who were old and had osteoporosis and/or minimal fractures. The bed rest period for these patients was only 2 weeks and then they were mobilized with TLSO for 8-10 weeks.

The other treatment methods such as bed rest without casting or bracing and supporting the patient's back with a rolling towel were used for 11% of patients if the patient had contrindications to treatment with cast or brace.

The patients were examined physically and radiologically after the treatment, at 6<sup>th</sup>, 10<sup>th</sup> weeks and 5<sup>th</sup> year.

The burst fractures without neurological impairment also were treated conservatively if the canal narrowing was under 40% and kyphosis angle was under 30 degrees.

**RESULTS**

In burst and compression fractures treated with hyperextension cast brace or TLSO, measured kyphosis angles before the treatment and at the last control were found significantly correlated (p<0.05). In burst fractures, measured canal dimensions before the treatment and at the last control also were found significantly correlated (p<0.05) (Table 1,2).

We did not observe neurological impairment in any case treated conservatively.

Table 1. Measured values before the treatment, soon after the treatment and at the last control.

|    | Burst fractures                  | Chance                               | Seat-Belt                                   | Flexion-Rotation                               | Flexion-Distracton | Compression |
|----|----------------------------------|--------------------------------------|---|--|--------------------|-------------|
| 1  | 20.45                            | 5.20                                 | 16.25                                       | 10.00  | 9.00               | 14.74       |
| 2  | 11.44                            | 3.20                                 | 9.45  | 3.00   | 5.80               | 8.38        |
| 3  | 10.20                            | 3.20                                 | 10.36                                       | 4.50   | 6.10               | 10.37       |
| 4  | 4.15                             | 0.00                                 | 3.00  | 5.00   | 2.00               | 3.48        |
| 5  | 3.77                             | 0.00                                 | 3.00  | 3.00   | 1.00               | 2.50        |
| 6  | 3.90                             | 0.00                                 | 3.00  | 3.00   | 2.00               | 2.83        |
| 7  | 17.75                            | 9.00                                 | 15.00                                       | 16.00  | 15.00              | 15.68       |
| 8  | 6.22                             | 7.80                                 | 8.00  | 12.00  | 10.50              | 9.04        |
| 9  | 7.20                             | 7.80                                 | 10.50                                       | 12.00  | 13.20              | 11.25       |
| 10 | 12.85                            | 11.20                                | 13.29                                       | 4.50   | 15.00              | 8.99        |
| 11 | 7.75                             | 2.80                                 | 9.45  | 2.35   | 12.00              | 3.04        |
| 12 | 4.20                             | 3.10                                 | 10.30                                       | 2.50   | 14.00              | 6.20        |
| 13 | 40.10                            | 14.50                                | 33.15                                       | 34.50  | 26.00              | 31.70       |
| 14 | 25.77                            | 10.45                                | 15.35                                       | 12.50  | 19.00              | 20.32       |
| 15 | 26.25                            | 10.50                                | 15.50                                       | 12.50  | 22.00              | 24.76       |
| 16 | 5.45                             |                                      |   |  |                    |             |
| 17 | 6.80                             |                                      |   |  |                    |             |
| 18 | 7.25                             |                                      |   |  |                    |             |
| 19 | 12.35                            |                                      |   |  |                    |             |
| 20 | 12.40                            |                                      |   |  |                    |             |
| 21 | 12.40                            |                                      |   |  |                    |             |
| 1  | Kyphosis angle before treatment  | 6: Late term scoliosis angle         | 11: Vertebrae index after treatment         | 16: AP canal dimension before treatment        |                    |             |
| 2  | Kyphosis angle after treatment   | 7: Wedge index before treatment      | 12: Late term vertebrae index               | 17: AP canal dimension after treatment         |                    |             |
| 3  | Late term kyphosis angle         | 8: Wedge index after treatment       | 13: Height loss percentage before treatment | 18: Late term AP canal dimension               |                    |             |
| 4  | Scoliosis angle before treatment | 9: Late term wedge index             | 14: Height loss percentage after treatment  | 19: Bilateral canal dimension before treatment |                    |             |
| 5  | Scoliosis angle after treatment  | 10: Vertebrae index before treatment | 15: Late term height loss percentage        | 20: Bilateral canal dimension after treatment  |                    |             |
|    |                                  |                                      |   | 21: Late term bilateral canal dimension        |                    |             |

Table 2. Improvement in before treatment and late term values as percentage

|        | Burst fractures | Chance   | Seat-Belt | Flexion-Rotation | Flexion-Distracton | Compression |
|--------|-----------------|----------|-----------|------------------|--------------------|-------------|
| 1..... | 51%.....        | 39%..... | 37%.....  | 55%.....         | 33%.....           | 30%.....    |
| 2..... | 33%.....        | 0%.....  | 0%.....   | 40%.....         | 0%.....            | 19%.....    |
| 3..... | 60%.....        | 14%..... | 30%.....  | 25%.....         | 12%.....           | 29%.....    |
| 4..... | 68%.....        | 73%..... | 23%.....  | 45%.....         | 7%.....            | 32%.....    |
| 5..... | 35%.....        | 28%..... | 54%.....  | 64%.....         | 16%.....           | 22%.....    |

1: Kyphosis angle improvement percentage  
 2: Scoliosis angle improvement percentage  
 3: Wedge index improvement percentage  
 4: Vertebrae index improvement percentage  
 5: Height loss improvement percentage

We presented the clinical results in pain and work scales (Figure 2,3). These scales were used by Denis in 1984 in his original article. In pain scale: P1, no pain; P2, occasional minimal pain with no need for medication; P3, moderate pain with occasional medication but no interruption of work or significant change in daily living activities; P4, moderate to severe pain with frequent medication and occasional absence from work or significant change in daily living activities; P5, constant or severe incapacitating pain and chronic medication. In work scale: W1, returned to previous employment (heavy labor); W2, able to return to previous employment (sedentary) or return to heavy labor full time with lifting restrictions or job modifications; W3, unable to return to previous employment but working full time at a new job; W4, unable to return to previous employment-working part time or frequently absent from work because of pain; W5, no work-completely disabled (6).

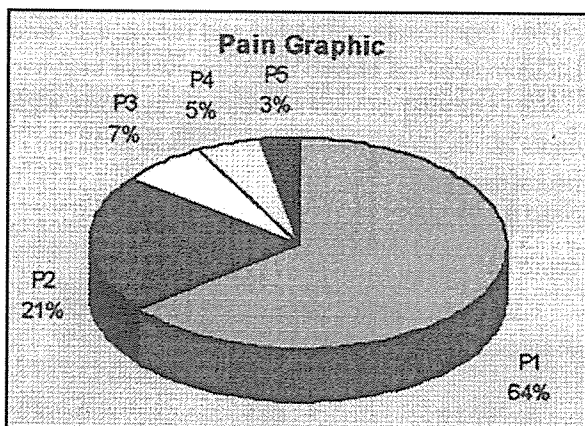


Figure 2. Pain levels of patients.

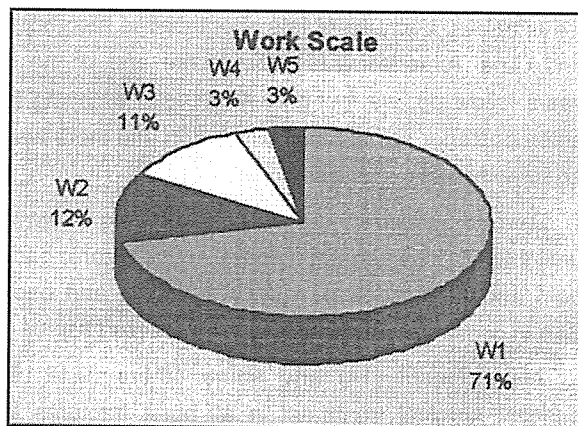


Figure 3. Working levels of patients.

**DISCUSSION**

According to Jacobs, an unstable vertebra fracture should be treated by the way to decrease all effecting loads which may cause fragment displacement (16).

Gaines also suggests that an unstable fracture can be treated by bed rest successfully. But the same fracture, when under affecting loads, may cause mechanical or neurological instability. This suggestion is in contradiction with the opinion to treat all unstable fractures surgically (10).

According to Crompinger et al., surgical indications are; patients who have spinal cord injury except one root damage, translated, flexion-rotation type and three column fractures, fractures with kyphosis angle over 30 degrees (13).

There is a general agreement to accept the

fractures with neurological impairment unstable.

But there is much controversy in the stability and the treatment modalities of burst fractures without neurological impairment. The discussion is on the resorption and remodeling of the spinal canal and which fracture can cause late collapse and symptomatic spinal stenosis. There are many publications about the prognosis of fragments in the spinal canal after burst fractures. Some authors, depending on late term CT studies, defend that fragments in the spinal canal can not be a surgical indication unless there is initial neurological deterioration, because of late spontaneous resorption and canal remodeling (11,19). At the end of the 5 years follow up, we found 15.4 % mean widening in anteroposterior spinal canal dimension and there was no symptomatic spinal stenosis.

Dewald accepts the burst fractures always unstable (7). Howarth and Landoff notice chronic back pain and Whitesides persistent kyphosis and back pain in conservatively treated burst fractures (20).

Also Lindahl (14) and some others (9,12,16) suggest surgical treatment in all burst fractures to prevent persistent kyphosis, chronic back pain and late neurological deterioration. Although there were chronic back pain in 10% of our cases at the last control, no neurological deterioration was found.

According to Cromptinger, patients with two-column fracture should be accepted stable and treated conservatively, unless kyphosis angle is over 30 degrees and canal narrowing over 50% (21).

Denis, in 1983, presented his three column theory and classification of instability. According to Denis, there are three degrees of instability. First degree instability is only mechanical. Compression and seat-belt fractures are in this category. Second degree instability is only neurological and two-column burst fractures are seen in this category. These fractures might cause late neurological impairment initially (4,5).

While planning the treatment, we used Cromptinger's and Denis' criteria.

McEvoy and Bradford suggest conservative treatment in these fractures, too (17).

Also, there is a latest paper comparing the hyperextension cast brace with internal fixation and proposes the former in neurologically intact burst fractures (2).

Domenicucci suggests that in patients with sagittal index under 20 degrees, conservative and surgical results are the same (8).

According to Bedbrook, unstable burst fractures with posterior widening due to posterior soft tissue damage can be treated with conservative methods and bed rest. Anderson presented the results of 24 cases with posterior ligamentous damage treated with hyperextension cast brace. In that series, although some amount of relapsed kyphosis was present, clinical results were found to be good, very good and excellent in 80% of the patients (1).

Still rare articles can be seen in the literature proposing early mobilization with cast brace or TLSO in these unstable fractures (3).

The most important complications seen in conservatively treated patients are persistent kyphosis, compensatory lordosis, chronic back pain and spinal stenosis. Kyphosis over 30 degrees due to late vertebral collapse generally causes complaints. Levine suggests to perform operation in patients kyphosis angle over 30 degrees and canal narrowing over 50% to avoid these late complications (14).

In conclusion, evident improvement in kyphosis angles, significantly correlated end results and fewer late complications proved that conservative treatment is a successful method in cases with kyphosis angle under 30 degrees, canal narrowing under 50% and no neural damage.

It is a cheap method especially in developing countries.

It is a safe method, because it provides avoidance of surgical complications.

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