# POSTERIOR INSTRUMENTATION IN THE TREATMENT OF VERTEBRAL INSTABILITY DUE TO POST-NEUROSURGICAL PROCEDURES

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***ABSTRACT:***

*Spinal instability is unavoidable after total laminectomy in the treatment of intraspinal neural tumor excision and protruded disc excision. In order to prevent a probable spinal instability, posterior instrumentation and fusion was performed with the collabration of treatment of 6 patients with intraspinal tumor excision and 5 patients with multilevel discectomy. Mean age was 31.1. Two patients had Isola Spinal Instrumentation, 2 had Alıcı Spinal Instrumentation and 7 had TSRH Instrumentation. Mean follow up was 14.6 months. A solid fusion mass was observed in all patients and any spinal instability was not revealed after postoperative radiological and clinical evaluation. In light of these findings it is suggested that posterior instrumentation is needed for the preventation of spinal instability after neurosurgical procedures.*

***Key Words:*** *Spinal instability, laminectomy, spinal instrumentation, posterior.*

## INTRODUCTION

Clinical spinal instability is defined as the loss of the ability of the spine under physiologic loads to maintain relationship between vertebrae in such a way that there is neither initial nor subsequent damage to the spinal cord or nerve roots, and in addition there is no development of incapacitating deformity or severe pain (2, 18). One of the main causes of clinical instability is trauma which damages anterior and posterior ligaments. Also infections, tumoral and degenerative diseases cause instability with the same mechanism (4, 10, 12, 15, 17). Spinal instability can also be produced iatrogenically. Instability is unavoidable in spinal stenosis patients which require extensive decompression, intraspinal tumor excision, extensive laminectomy and bilateral facet excisions due to multilevel disc excisions. There are number of reports suggesting spinal fusion and instrumentation after such procedures with invivo and clinical studies (1-2, 5-6, 12, 14, 16-18).

In this study the results of 11 patients who had intraspinal tumor excision or extensive laminectomy and facetectomy for multilevel discectomy and posterolateral fusion and posterior instrumentation to prevent clinical instability are evaluated.

## MATERIAL AND METHOD

Eleven patients were included in this study that were operated at between February 1994 and December 1994. Ages ranged between 17 and 43 with a mean of 31.1 years. Four of the patients were female and 7 were male. Mean follow-up was 14.6 months. The last controls of the patients were done in December 1995.

Patients admitted to the Neurosurgery Department especially with back pain, sensation loss, urinary incontinance and inability to walk and were hospitalized after routine laboratory tests, conventional radiograms and MR imaging. Six of the patients had intraspinal tumor and 5 had multilevel disc herniation. Nucleus excision, intraspinal tumor excision were performed with the neurosurgeons after minimum 2 maximum 10 level total laminectomy. These unstable levels, were instrumented with transpedicular screws or hooks which include the upper and lower healthy levels and posterolateral fusion was performed with iliac otogenous grafts by the orthopaedic surgeons. Two patients had Isola Spinal Instrumentation, 2 had Alıcı Spinal Instrumentation and 7 had Texas Scottish Rite Hospital (TSRH) Instrumentation.

The patients were encouraged to walk in the 3rd postoperative day and were discharged on the 10th postoperative day. The conventional radiograms and MRI studies were repeated at the follow up visits on the 1st, 3rd, 6th and 12th months. Patients were evaluated clinically and radiologicaly at the last controls for instability with White and Panjabi Stability Criteria or

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Posner Instability Criteria (1, 18) (Table 1-2) and Pain and Functional Assesment (PFA) scale (9) (Table 3).

**Table 1.** Checklist for Diagnosis of Clinical Instability in Thoracic and Thoracolumbar Spine.

| Elements | Point Value |
|---|---|
| Anterior elements destroyed or unable to function | 2 |
| Posterior elements destroyed or unable to function | 2 |
| Relative sagittal plane translation > 2.5 mm | 2 |
| Relative sagittal plane rotation > 5 degrees | 2 |
| Spinal cord or cauda equina damage | 2 |
| Distruption of costovertebral articulations | 1 |
| Dangerous loading anticipated | 2 |

**Table 2.** Checklist for Diagnosis of Clinical Instability in the Lumbar Spine

| Elements | Point Value |
|---|---|
| Cauda Equina damage | 3 |
| Relative flexion sagittal plane translation or extension sagittal plane translation > 10 % | 2 |
| Relative flexion sagittal plane rotation > 10° | 2 |
| Anterior elements destroyed | 2 |
| Posterior elements destroyed | 2 |
| Dangerous loading anticipated | 1 |

## RESULTS

Age, pathological diagnosis and operated sites of the patients are seen in Table 1. Of 6 patients with intradural tumor, two we had intramedullary tumor (NS; Schwannoma, FR; Astrasitoma). The remaining 4 patients had extramedullary intradural tumors. The minimum tumor mass length spanned two mobil segments and maximum 9 mobil segments.

All of the patients had severe back pain. Three of the patients had 3-4/5 grade strength loss and segmental hypoesthesis. Two patients had paresthesis. One patient did not have any neurological deficit whom menengioma was diagnosed after MRI incidentally. As can be seen from Table-4, postorolateral fusion was extended to 1 or 2 more healthy mobil segments when extensive laminectomy exceeded 2 levels or multilevel bilateral facetectomies were performed.

**Table 3.** Pain assessment involves frequency and severity evaluated on anolog scales from 0 to 5, as shown. Functional capacity assessments are also evaluated on analog scales from 0 to 5, as shown. Pain and functional capacity assesment are completed preoperatively, as well as at each postoperative visit.

Pain And Functional Assessment (PFA) Scales

| |
|---|
| I. Pain Frequency (0 - 5)<br>0. No pain rare pain<br>1. Occasional pain about 1-2 episodes per year or so<br>2. Recurrent pain, a few days every few mos. or more often<br>3. Frequent pain, every month or more often that lasts longer<br>4. Very frequent pain, every week or more often<br>5. Pain every day, constant (yes, no) |
| II. Pain Severity (0 - 5)<br>0. No pain<br>1. Dull pain<br>2. Harder pain<br>3. More severe pain<br>4. Very severe pain<br>5. Extremely severe pain |
| III. Work Capacities<br>0. No limitation<br>1. Few limitation<br>2. Able with modifications<br>3. Must stop and limit, but mostly able<br>4. Frequently unable for long periods (days)<br>5. Unable, totaly disable |
| IV. Social Limitation<br>0. No limitation<br>1. Few limitation<br>2. Able to do all with pain<br>3. Able to do most with pain<br>4. Unable to do most things<br>5. Unable to do anything |

Thus minimum 3, maximum 10 mobil segments were instrumented. Postoperatively any neurologic compromise was noted, controversially all the patients had neurological improvement. Pain complaints regressed in all patients except one.

Disc herniations were in lumbar region in patients with multilevel disc herniations and these consisted of minimum 2, maximum 3 levels (Table 4). One patient had recurrent disc herniation at 4-5 level (No : 9). As the patients had minimum 2, maximum 3 level total laminectomy and bilateral facetectomy, minimum 3, maximum 4 level transpedicular TSRH screws instrumentation was performed and posterolateral fusion was added. All patients had severe multilevel root compression findings and 2 had urinary incontinence preoperatively. None of the patients had neurological deterioration postoperativey. Pain and neurological problems disappeared in all patients.

Preoperative, postoperative and follow-up evaluations of the patients according to PFA score are seen in Table 5. Preoperative PFA score which was averagely 14 (7-20) discreased to 1.1. This improvement was statistically significant ($p < 0.05$, t: 11.4).

The patients were regarded as unstable clinically as extensive decompression and bilateral facetectomy were performed. Patients with thoracic or thoracolumbar involvement were evaluated with Panjabi instability criteria, and patients with lumbar involvement were evaluated with Posner criteria. None of the patients had translation or rotation. Anterior elements were intact and solid fusion mass was observed. Recurrent cord involvement and neurologic deterioration wasn't, thus, thoracal and lumbar stability score was noted as "0".

Any implant failure was not observed postoperatively and at the follow-up. Early and late infection was not established.

## DISCUSSION

The largest study on clinical spinal instability belongs to White and Panjabi. They considered the importance of the destruction on especially anterior and posterior structures and translation and rotational amounts of these (12, 17-18). Postner has added cauda lesions to them and has evaluated lumbar region instabilities (12). Dennis has reported vertebral fractures and dislocations to be the most common reason for spinal instability (4). Additionally, intraspinal and primary vertebral tumors and spinal infections causes spinal instability (2, 10, 11, 15, 18).

Rosenberg in 1975 presented one of the first reports in the literature directed toward lumbar decompression in patients with degenerative spondylolisthesis. He described a 10 percent incidence of

**Table 4.** Age, sex, etiology and involvement site distrubation of the patients.

| No. | Name | Sex | Age | Diagnosis | Pathology | Level | Number of Mobile Segments | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bilateral total laminectomy and facetectomy | Instrumented and fused |
| 1 | EG | M | 40 | Intradural tumor | Neurofibroma | T12 - L44 | 3 | 4 |
| 2 | BE | F | 28 | Introdural tumor | Ependimona | T10 - L3 | 9 | 10 |
| 3 | NS | F | 35 | Intradural tumor | Schwannoma | T9 - L2 | 4 | 5 |
| 4 | BA | M | 22 | Intradural tumor | Menengioma | L1 - L4 | 2 | 3 |
| 5 | CD | F | 43 | Intradural tumor | Menengioma | T12 - L2 | 2 | 4 |
| 6 | FR | M | 40 | Intradural tumor | Astrositoma | T5 - T9 | 5 | 6 |
| 7 | MA | M | 17 | Disc Herniation | – | L3-4, L4-5 | 2 | 3 |
| 8 | TB | M | 20 | Disc Herniation | – | L4-5, L5-51 | 2 | 3 |
| 9 | AB | F | 41 | Disc Herniation | – | L2-3, 3-4, 4-5 | 3 | 4 |
| 10 | RT | M | 36 | Disc Herniation | – | L1-2, 2-3 | 2 | 3 |
| 11 | OG | M | 10 | Disc Herniation | – | L4-5, L5-S1 | 2 | 3 |

**Table 5.** Preoperative (PR), postoperative (PO) and follow-up values o fthe patients according to PFA scale.

| No. | PR | PO | Follow - up |
|---|---|---|---|
| 1 | 16 | 4 | 3 |
| 2 | 15 | 2 | 1 |
| 3 | 19 | 2 | 2 |
| 4 | 15 | 2 | 2 |
| 5 | 12 | 0 | 0 |
| 6 | 20 | 4 | 4 |
| 7 | 8 | 0 | 0 |
| 8 | 9 | 0 | 0 |
| 9 | 17 | 0 | 0 |
| 10 | 16 | 0 | 0 |
| 11 | 7 | 0 | 0 |
| Mean | 14.0 ± 4.4 | 1.3 ± 1.6 | 1.1 ± 1.5 |

$p < 0.05$ , t : 8.99

postoperative slip in 29 patients who had extensive decompression (13). White and Wiltse reviewed 182 cases of extensive laminectomies, of which 120 were for lumbar disc herniation of the 182 cases, 7 percent developed a slip postoperatively (19). Brown and Lackwood described postoperative slipping on 12 % (3). Abumi et al investigated the effect of stability of lumbar facet articulations and found that segmental instability produced after excision of over 50% of the facets in cadever (1). Herkowich and Sidhu reported with the excision of facets, pars articularis or intervertebral discs produced 30 % instability and suggested these cases to be fused or instrumented (8).

In this study 11 patients had extensive laminectomy and bilateral facetectomy. These patients were regarded as unstable preoperatively. Six of the patients had intradural tumor, 5 had disc herniation.

According to Garfin et al. instability due to wide decompression requires fusion (7). Also Wisneski et al. has accepted segmental instability due to multilevel discectomy and wide decompression as a fusion indication (20). Simone has reported that fusion is absolutely indicated in patients younger than 18 years after extensive facet excision and laminectomy due to postoperative subluxation and instability (15). In this study posterolateral fusion and instrumentation was performed in 11 patients.

Except one patient pain complaints and neurologic findings were resolved in all patients. Preoperative Functional Assessment (PFA) score which was average 14 decreased to 1.1 postoperatively. Clinical instability score was brought to 0 in all patients. A solid fusion mass observed in all patients. Silve et. al. has reported that instability risk is high in acute disc herniation in patients younger than 21 years and so, proposed that posterior fusion and instrumentation is needed (14). We have also 3 patients with multilevel disc herniations younger then 21 years and posterior fusion and instrumentations was performed to prevent instability.

Enker et al. has reported fusion and instrumentation lowers pseudoarthrosis rates significantly (5). For this aim, we used posterior instrumentation to hinder postoperative cast or brace immobilization and facilitate early mobilization. Pseudoarthrosis and implant failure was not observed in our study.

In light of these findings after wide and extensive facetectomy and laminectomy in especially young patients with multilevel disc herniation and intradural tumor, it is suggested that posterolateral fusion and instrumentation is indicated to prevent spinal instability and to provide satisfactory clinical results.

## REFERENCES

1. Abumi K, Panjabi MM, Kramer KM et al.: Biomechanical evaluation of lumbar spinal stability after graded fasetectomies. Spine 15: 1142-1147, 1990.
2. Bernhardt M, White AA, Panjabi MM, Mc Gowun DP: Biomechanical consideration of spinal instability. In: The Spine Eds. Rothman RH, Simeone FA. WB Saunders Company. Philadelphia, pp: 1167-1195, 1992.
3. Brown M, Lockwood S.: Degenerative Spondylolylisthesis. Instr Course Lect 28: 162-169, 1983.
4. Dennis F.: Spinal instability as defined by the three column spine concept in acute spinal trauma. Clin Orthop 189: 65-76, 1987.
5. Enker P, Steffee A.: Interbody fusion and instrumentation. Clin Orthop Rel Res 300: 90-101, 1994.
6. Frymoyer JW, Selby DK.: Lumbar segmental instability. Rationale for treatment. Spine 10: 280-286, 1985.
7. Garfin SR, Herkowitz HN, Mirkovic S, Booth RE.: In: The Spine, Eds. Rothman RH, Simeone FA. WB Saunders Company, Philadelphia, pp: 857-875, 1992.
8. Herkowitz HN, Sidhu KS.: Lumbar spine fusion in the treatment of dejenerative condition. Current indications and recommendations. J Am Acad Orthop Surgeons 3: 123-135, 1995.

9. Jackson RP, Ebelke DIC, McManus AC.: The sacroiliac buffers and new methods for correction with CD pedicle instrumentation. 8th Proceeding of the International Congress on Cotrel-Dubousset Instrumentation, Sauramp Medical, Montpellier pp: 135-159, 1991.
10. Mumcu EF, Benli T, Akalın S et al.: Anterior or posterior stabilization for primary and metastatic spinal tumors. J. Spin Turk Surg 5: 170-173, 1994.
11. Neuman P, Nordwall A, Osvalder AL.: Traumatic instability of the lumbar spine. Spine 20: 1111-1121, 1995.
12. Posner I, White AA, Edwards WT et al.: A biomechanical analysis of clinical stability of the lumbar and lumbosacral spine. Spine 7 : 374-381, 1982.
13. Rosenberg NJ.: Degenerative spondylolisthesis. J Bone Joint Surg 57 (A) : 467-474, 1975.
14. Silvers HR, Lewis J, Claheaux DE, Asch HL.: Lumbar disc excision in patients under the age of 21 years. Spine 19 (21) : 2387-2392, 1994.
15. Simeone FA.: Intradural tumors. In: The Spine-Eds. Rothman RH, Simeone FA. WB Saunders Company, Philadelphia, pp: 1515-1528, 1992.
16. Spencer DL.: Lumbar Intervertebral disc surgery. In: Surgery of the Musculoskeletal system. Ed. Evarts CMC., Churchill Livingstone, New York pp: 675-698, 1990.
17. White AA, Panjabi MM.: Clinical Biomechanics of The Spine. JB Lippincott, Philadelphia, 1978.
18. White AA, Panjabi MM.: Clinical instability of the spine. In: Surgery of the Musculoskeletal system. Ed. Evarts CMC., Churchill Livingstone, New York pp: 2151-2173, 1990.
19. White AH, Wiltse LL.: Postoperative spondylolisthesis. In: Lumbar spondylosis. Diagnosis, Management and Surgical Treatment. Weinstein PN, Ekni G, Wilson CB, Year Book Medical Publishers. pp: 184-194, 1977.
20. Wisneski RJ, Garfin SR, Rothman RH.: Lumbar Disc Disease. In: The Spine. Eds. Rothman RH, Simeone FA. WB Saunders Company, Philadelphia, pp: 671-746, 1992.