



## PEDICLE MORPHOLOGY OF THE THORACOLUMBAR JUNCTION IN A TURKISH POPULATION: A PRELIMINARY STUDY

Abdullah MILCAN<sup>(1)(B)</sup>, Caner ÖZER<sup>(2)(O)</sup>, Volkan ÖZTUNA<sup>(1)(O)</sup>, Metin M. ESKANDARI<sup>(1)(O)</sup>,  
Mehmet COLAK<sup>(1)(O)</sup>, Fehmi KUYURTAR<sup>(1)(O)</sup>

### *Institution(s)*

<sup>1)</sup> Me. Ü. TF. Ortopedi Ve Travmatoloji A.D.; Mersin Üniversitesi Tıp Fakültesi Hastanesi  
Zeytinlibahçe Cad. Ortopedi Ve Travmatoloji Kliniği, Mersin

<sup>2)</sup> Me. Ü.T.F. Radyodiagnostik A.D.; Mersin Üniversitesi Tıp Fakültesi Hastanesi Zeytinlibahçe Cad.  
Radyodiagnostik A.D. Mersin

**Objective:** To outline the bilateral pedicle diameter and angulation in the transverse plane at the thoracolumbar junction in a Turkish population.

**Methods:** CT scans of 75 patients with dorsolumbar pain but no radiographic signs of bony disease or deformity were investigated between November 2000 and January 2002. There were 15 males and 60 females. The mean age of the patients were 41 years (12-60).

**Results:** The mean diameter of the right pedicle at T11 was  $5,9 \pm 1,3$  mm, and that of the left was  $5,8 \pm 1,4$  mm. At T12 they were  $5,9 \pm 1,3$  mm and  $6,2 \pm 1,4$  mm; at L1  $5,5 \pm 1,3$  mm and  $5,6 \pm 1,4$  mm, and at L2  $5,7 \pm 1,3$  mm, and  $5,9 \pm 1,3$  mm respectively. The angulation of the right pedicle

at T11 in the transverse plane was  $10,04^\circ \pm 3,2^\circ$ , and that of the left was  $10,5^\circ \pm 3,6^\circ$ . At T12 they were  $9,4^\circ \pm 2,4^\circ$ , and  $10,3^\circ \pm 3,1^\circ$ ; at L1 (11),  $4 \pm 2,7^\circ$  and  $12,3^\circ \pm 3,2^\circ$ ; and at L2 (12),  $4^\circ \pm 2,9^\circ$  and  $12,9^\circ \pm 3,2^\circ$  respectively.

**Conclusion:** Accurate placement of the pedicle screws are important in preventing complications such as pedicle fracture, cutting out of the pedicle, and injuring neurovascular structures.

Although the morphometric analysis of the pedicles at the thoracolumbar junction were in accordance with the results of studies performed in Turkish population, they were different when compared with that of American, European and Chinese series.

## POSTEROLATERAL THORACOLUMBAR SPINAL FUSION WITH COMPOSITE OF ALLOGENIC DEMINERALIZED BONE MATRIX (DBM) AND AUTOLOGOUS BONE GRAFT

Can SOLAKOGLU<sup>(1)(B)</sup>, Cemil YILDIZ<sup>(1)(O)</sup>, Ali SEHIRLIOGLU<sup>(1)(O)</sup>, Mehmet ALTINMAKAS<sup>(1)(O)</sup>

*Institution(s)*

1) GATA Military Medical Academy; Department of Orthopedics and Traumatology, Etlik-06018  
Ankara/Turkey

Autologous bone grafts are often used and accepted as crucial to promote bone mineralization and facilitate solid fusion in spinal surgical procedures. But the necessity of large amounts in spinal surgery and the limitations of the autogenous bone grafts have prompted the investigation of a variety of bone graft substitutes and graft extenders.

Today, DBM is accepted as an effective graft material that functions by induction of osteogenesis through the stimulation of factors, which causes bone formation through the chain of enchondral ossification. We aimed in this study to present our results in spinal cases that were treated with posterolateral fusion by using the composite of DBM and autologous bone graft, thus obviating the need for large amounts of autologous bone grafts.

We included 48 cases (23 female, 25 male) which were treated with posterolateral spinal fusion in our institution between August 2000 and December 2001. Average age of the cases was 41.3 (range:16-65). Fracture in 16 cases (33.3%), scoliosis in 12 cases (25%), spondylolisthesis in 9 cases (18.75%), spinal stenosis in 8 cases (16.6%) and kyphosis in 3 cases (6.25%) were the primary etiologies in our patients. These cases were treated with posterior instrumentation together with posterior fusion which was applied by mixing autologous bone

graft and DBM in the form of poly or flex-o-gel. DBM amounts were 5 cc in 5 cases (10.41%), 10 cc in 33 cases (68.75%), and 20 cc in 10 patients (20.83%).

Our average follow-up period was 8.5 (range: 2-16) months. Postoperative anteroposterior and lateral radiographs were taken at 2 month time intervals and the patients were evaluated independently and concurrently by the same orthopedic surgeon and the same radiologist. A four point, semi-quantitative scale was used to judge the apparent radiographic density, a reflection of bone mineralization of the developing bone graft mass at the fusion site. The scale was defined as ABSENT, MILD, MODERATE and EXTENSIVE, indicating the bone mineralization over the operative field. We observed both clinical and radiological union in all cases and the distribution was moderate in 15 (31.25%) and extensive in 33 (68.75%) cases. Average consolidated union time was 3 (range: 3-5) months. We did not observe any complication due to allogenic DBM usage.

This study showed that using DBM with autologous bone graft increased our success rate, decreased pseudoarthrosis rate to at most zero, decreased the necessity for large amounts of autologous bone graft and also decreased the time needed for consolidated union.

## FAST LOW-ANGLE SHOT MR IMAGING IS A USEFUL STRATEGY FOR DIAGNOSIS OF LUMBAR DISC HERNIA

Norisuke SATORI<sup>(1)(B)</sup>, Akira TAGAYA<sup>(1)(O)</sup>, Ban MIHARA<sup>(1)(O)</sup>, Shintaro GOMI<sup>(2)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Institute of Brain and Blood Vessels Mihara Memorial Hospital; 366 Ohtamachi, Iseaki, Gumma, Japan*

<sup>2)</sup> *Aoyama Gakuin University; 4-4-25 Shibuya, Shibuyaku, Tokyo, Japan*

**Introduction:** The information on the herniated form of nucleus in lumbar disc hernia (HNP) is crucial to estimate the prognosis. However, conventional MRI is not always a useful strategy. We examined the patients with lumbar HNP with Fast low-angle shot (FLASH) MRI and assessed its efficacy in the form diagnosis of HNP.

**Subject:** We studied 12 patients with HNP (31.6 y/o). There were 11 males and 1 female.

**Methods:** MRI was performed at 1.5 Tesla. T1, T2, and FLASH images at each herniated disc were obtained. In the operated cases, they were confirmed macroscopically.

**Results:** On FLASH, all the hernia masses were depicted obviously, and the posterior longitudinal ligaments (PLL) were observed as black line. The boundary of the hernia mass was clearer than that on T1. The images of ligamentum flavum were also apparent. In 8 operative cases, we predicted the herniated nucleus form from the continuity of black line on FLASH and

these cases were divided into transligamentous (TL) and subligamentous (SL) extrusion. These findings were identical to those obtained during the operation except for one case, in which we could not determine the form on FLASH. However, according to operation finding this case was diagnosed as the TL double-layer hernia. The results were confirmed macroscopically. In 3 with TL on FLASH of 4 non-operative cases, their symptoms were improved and the size of hernia masses was reduced. In one SL case on FLASH, the improvement was less remarkable.

**Discussion and Conclusion:** On FLASH, the differences in signal density among tissues are remarkable. The form of the herniated nucleus was accurately determined, since the boundary between the hernia mass and PLL is more apparent than on T1. FLASH is less invasive comparing to T1, as it needs no injection of contrast media and shorter seen time. Our findings indicate that FLASH is a useful measure in the diagnosis of HNP form.

## ENDOSCOPICALLY CHECKED TRANSPEDICULAR SCREW INSERTION- PRELIMINARY REPORT

Tarık YAZAR<sup>(1)(B)</sup>, Sinan BILGIN<sup>(1)(O)</sup>, Atac KARAKAS<sup>(1)(O)</sup>, Cengiz YILMAZ<sup>(1)(O)</sup>

*Institution(s)*

*<sup>1)</sup> Department of Orthopedics and Traumatology; University of Ankara Medical School Ibn-i Sina Hospital, Samanpazari, Ankara*

**Study Design:** Transpedicular screws are one of the most important components of the posterior segmental fixation systems. Their most feared complication is the possibility of neural damage both while insertion and after the operation, due to compression of the malpositioned screw on the neural structures. We check the screw hole endoscopically prior to insertion of the screw and directly inspect the pedicle walls.

**Objectives:** Inspection of the screw hole endoscopically would prevent malpositioning of the transpedicular screws and would thus decrease complications related to them.

**Summary of Background Data:** There are reports in the literature about complications related directly to malpositioning of the transpedicular screws. Currently the insertion method of the

screws is composed of palpation of the pedicle walls by the help of a guide K-wire.

**Methods:** In 4 cases of spinal stenosis with instability, we endoscopically examined 16 screw holes prior to insertion of the screws.

**Results:** In one of the cases anterior penetration of the hole through the corpuscular wall was detected and a shorter screw was inserted. In another case osteopenic bone was visualized and the pedicle was grafted before insertion of the screw.

**Conclusions:** Complications due to malpositioned screws can be prevented by endoscopic visualization of the screw hole. We believe, although it adds to the total operative time, avoiding the unpredictable complications worth the time spent.

## A COMPARATIVE STUDY OF BEHAVIORAL AND IMMUNOHISTOCHEMICAL CHANGES AFTER SPINAL CORD INJURY BETWEEN YOUNG AND ADULT RATS

Jun-Young YANG<sup>(1)(B)</sup>, June-Kyu LEE<sup>(1)(O)</sup>, Kyung-Cheon KIM<sup>(1)(O)</sup>

*Institution(s)*

1) *Department of Orthopaedic Surgery, Chungnam National University Hospital, Daejeon, Korea; 640, Daesa-dong, Jung-gu, Daejeon, Korea, 301-721*

**Purpose:** Mechanism of the changes in spinal cord injury (SCI) according to age has not been well established. The aim of this study was to compare the behavioral and immunohistochemical changes in SCI between young and adult rats and to clarify differences of the underlying mechanism of the changes in SCI between young and adult rats.

**Material & Methods:** A total of 25 young and 25 adult male Sprague-Dawley rats (5 weeks and 16 weeks) were used. Rats were anesthetized with pentobarbital and laminectomies at the level of the eleventh and twelfth thoracic vertebra. Using a modified New York University Impactor SCI was induced by dropping a 10 gm weight at a height of 20 mm. Bladders were emptied manually two times every day to prevent urinary problems. Animals that received no surgery were used as normal controls. Behavior tests of rats subjected to spinal cord injury were performed by Basso-Beattie-Bresnahan (BBB) scoring. Testing was done 1, 3, 5 and 7 days after weight drop injury. The difference in the BBB score between young and adult rats were analyzed by paired t-test with significance at  $p < 0.05$ . The injured spinal cords were dissected at 1, 3, 5 and 7 days after surgery. H-E stain and immunohistochemistry for c-Jun and GFAP were performed in the spinal cord sections. Immunoreactions were visualized by incubation for 1 hour at

RT in avidin-biotin-peroxidase complex in PBS and 5-10 min in 0.05% 3,3-diaminobenzidine and 0.01 %  $H_2O_2$  in 0.1M PBS.

**Results:** The hind limbs of young rats were paralyzed 1 day after surgery, but recovered partially 7 days after surgery. However, adult rats were remained in paralyzed status at 7 days after surgery. c-Jun expression increased in the gray matter up to 7 days after weight-drop injury in adult rats. c-Jun expression increased significantly in the gray matter 1 day after injury in young rats. However, c-Jun expression decreased significantly in the gray matter 7 days after injury in young rats compared to 1 day post-injury. GFAP expression in the gray matter increased 1 day after weight-drop injury in adult rats. However, GFAP expression decreased in the necrotic region 7 days after injury in adult rats. GFAP expression in gray matter increased gradually to 7 days after injury in young rats.

**Conclusion:** These data suggest that severe neurodegeneration in the spinal cord of adult rats may be related to continuous upregulation of c-Jun expression and/or down regulation of GFAP after weight-drop injury. Inversely, upregulation of GFAP expression and/or down regulation of c-Jun expression in the spinal cord may be related with neuroprotective feature in the spinal cord of young rats after weight-drop injury.

## THE CHANGES IN EXPRESSION OF TUMOR NECROSIS FACTOR RECEPTOR I AFTER SPINAL CORD INJURY

Jun-Young YANG<sup>(1)(B)</sup>, June-Kyu LEE<sup>(1)(O)</sup>, Sang-Yun CHUNG<sup>(1)(O)</sup>, Chang-Hwa HONG<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Department of Orthopaedic Surgery, Chungnam National University Hospital, Daejeon, Korea; 640, Daesa-dong, Jung-gu, Daejeon, Korea, 301-721

**Introduction:** Tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) is a protein that reacts to inflammation or chronic stress and is known to have a role in cell survival and death, although its exact mechanisms have not yet been clarified. Also, it is known to increase in concentration within the neurons, neuroglia, and vascular endothelium after spinal cord injury (SCI), but the expression of TNF- $\alpha$  receptor has not been made clear. In this study, we examined the expression of TNF receptor (TNFRI) according to time after SCI.

**Materials and Method:** 45 of the 16 week-old Sprague-Dawley rat were used. After anesthetizing with intraperitoneal injection of 50 mg/kg pentobarbital, laminectomy was performed on the first and second lumbar vertebrae. After exposing the dura mater, spinal cord injury was induced using the neuroimpactor with 200g-mm force. Then on the first, third, fifth, and seventh days, postoperatively, ten rats each were sacrificed, and in situ hybridization for TNFR1

was performed to observe the change in the expression of TNFRI mRNA. 5 rats without SCI were control.

**Results:** No expression of TNFRI mRNA was observed in the healthy spinal cord, but one day after SCI, TNFRI mRNA expression was clearly increased not only in oligodendrocytes but also in neurons and ependymal cells of the central canal. On the third day after injury, TNFRI mRNA was expressed in a portion of the neurons; fifth day also showed decrease in the expression, and on the seventh day. The expression much below the level of the third day.

**Conclusion:** In this study, we found that in the early stage after spinal injury, various types of cells such as neurons, oligodendrocytes, and ependymal cells of the central canal are influenced by TNF- $\alpha$ . Further studies should be made on the adaptor protein for TNFRI to elucidate the mechanism of apoptosis after SCI.

## ONE STAGE SPONDYLODESIS FOR THE BURSTING FRACTURE OF THE THORACOLUMBAR SPINE. - TECHNICAL NOTE-

Young-baeg KIM<sup>(1)(B)</sup>, Kazunari TAKEUCHI<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Chung-Ang University Hospital; Department of Neurosurgery, Chung-Ang University Hospital, Yongsanku, Seoul, 140-757, Korea(South)

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**Objective:** The purpose of this study is to report the technical feasibility and the result of one stage operation for the bursting fracture of the thoracolumbar spine.

**Method:** Three patients underwent corpectomy and replaced the space with titanium mesh cage filled up with autologous bone pieces through unilateral posterior route after removal of the facet joint and the pedicle followed by pedicle screw fixation at the same surgical field.

**Result:** All patients tolerated the procedures well. Postoperative radiographs showed the effective decompression and well placed instru-

ments. Preoperative neurological deficits disappeared completely in one patient but some deficits persisted in the remainders. In one patient, epidural venous bleeding was troublesome and he needed transfusion of 5 pints of whole blood. To insert the mesh cage through the narrow corridor posterolaterally, it was unavoidable to sacrifice one spinal root.

**Conclusion:** In spite of technical difficulty, one stage spondylodesis for the bursting thoracolumbar spine seem to be an effective operative procedure.

## LATE RESULT OF THE VERTEBROPLASTY

Byungjik KIM<sup>(1)(B)</sup>, Jeonggook SEO<sup>(1)(O)</sup>, JinHwan KIM<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Dept. of Orthopedic surgery, Inje University, Ilsanpaik Hospital; 2240, Daehwadong, Ilsanku, Koyangsi, Kyungkido, South Korea

**Study Design:** Retrograde evaluation of the result of vertebroplasty minimum 18 months follow-up.

**Objectives:** To evaluate the late result of the percutaneous vertebroplasty for the painful osteoporotic vertebral compression fracture.

**Material and Methods:** 24 vertebroplasty procedures were done from Dec. 1999 to June 2000 for the painful osteoporotic compression fracture of the thoracolumbar spine. Among them, 14 cases were followed up more than 18 months.

Evaluation was done for the pain and function and radiologic examination.

**Results:** Of the 14 patients, 9 (64,3%) were good and excellent, 2 (14,3%) were fair and 3 (21,4%) were worse.

**Conclusion:** Vertebroplasty is relatively safe and effective in early and late (mean 18 months after) but development of the new material instead of bone cement is recommended and further long term follow up is necessary to be used in young patient.



## TREATMENT RESULTS OF LOW LUMBAR BURST FRACTURES

Ufuk AYDINLI<sup>(1)(B)</sup>, Cagatay OZTURK<sup>(1)(O)</sup>, Remzi Ozgur OZER<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Faculty of Medicine Department of Orthopaedic Surgery; Uludag University, 16059 Görükle-Bursa-Turkey*

**Objective:** Low lumbar burst fractures (L3-L5) represents the small percentage of all spine fractures. Treatment of fractures involving low lumbar spine has been controversial. Early studies of operative treatment showed a high complication rate and more recent studies demonstrate adequate outcome with nonoperative treatment.

**Methods:** Twenty-six patients with low lumbar burst fractures were treated from 1995 through 2001. Medical records, preoperative and last follow-up radiographs were obtained. Loss of anterior vertebral height, kyphotic angulation and amount of bony retropulsion to the spinal canal were calculated at preoperative and last follow up examinations. Functional results for all patients were based on comparison of the patients occupational and recreational status before the injury and after it. These results were classified as excellent, good, fair or poor according to Smiley-Webster Scale.

**Results:** Twenty-six patients (twenty-eight low lumbar burst fractures) were treated with an average follow-up of 39.5 months (12-80 months). Female to male ratio was 5/21 and mean age was 37 years (17-64). The most common etiological factor was fall from height (24/26).

Five of the patients were treated conservatively by immobilization for averagely 3 months in a thoracolumbar orthosis. The remaining cases underwent surgery. Indications for surgery were neurologic impairment in 9 patients and/or instability/deformity in 14 patients.

Of the surgically treated group, 2 patients were treated with anterior, 10 patients with posterior and 9 patients with combined approach. Seven patients with low lumbar burst fractures had traumatic dural tears and extravasation of the nerve roots outside the dural sac. All patients underwent laminectomy, replacement of the roots within the dural sac and primary dural repair in addition to instrumentation and fusion procedures. Six patients showed complete neurological recovery in follow-up and one was neurologically intact prior to surgery and remained same. Two patients from the surgically treated group required hardware removal due to deep wound infection and migration of screws into the disc space in the postoperative 24 months and 7 months respectively. The functional outcome of the entire study group was assessed using the Smiley Webster Scale. Good to excellent results were obtained in 24 (92%) of 26 patients (100% for nonoperative group, 90% for operative group).

**Discussion and Conclusion:** Low lumbar burst fractures occur in a relatively young population affecting the most mobile and highly stressed portion of their spine. If patients are neurologically impaired in association with low lumbar burst fractures, surgical treatment is effective. In the case of dural tear, it is not possible to detect the tear and nerve root entrapment in greenstick lamina fracture before the surgery. So, it must be the rule to expose the dura safely with posterior approach before any reduction maneuver.

## TRANSFORAMINAL DECOMPRESSION OF BURST FRACTURES OF THORACOLUMBAR VERTEBRAE (A NEW TECHNIQUE)

H. KUTLU<sup>(1)(B)</sup>, E. MERİH<sup>(1)(O)</sup>, T. SENER<sup>(1)(O)</sup>, C. MIRZANLI<sup>(1)(O)</sup>, A.N. KARA<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Orthopaedics and Traumatology Clinic; Vakıf Gureba Hospital, Istanbul, Turkey*

In the burst fractures the middle column of the corpus occupies the spinal canal under the axial loading. It means mechanical and neurological instability. Decompression and the mechanical support of anterior column is the major aim of surgical treatment in this type of the fractures. Here we have to decompress the neurological structures without additional instability and also we have to check the decompression intraoperatively. In the present techniques which are laminectomy, posterolateral and anterior decompression additional instability is created. Similarly anterior support and decompression can not be managed sufficiently in indirect decompression. And also we can not check the decompression intraoperatively in indirect technique.

So we have to need a technique which reconstruct the corpus and decompress the neural structures without any additional mechanical instability. In our technique we remove the

one side of the ligamentum flavum and the bony edge of the related lamina creating foramina as in discectomy. The fragments are pushed to anatomic place by using special instruments which are gradual in size. Also we can check the decompression during the surgery by the same instruments.

In our clinic from 1997 to end of the 2001 we treated 12 patients with this method. We had no difficulty during and after the surgery. And also we have no complication related to the technique. And in our prospective study the clinical outcome was ranging from sufficient to excellent.

As a result the transforaminal decompression technique is safe, easy and gives the chance of controlled decompression and reconstruction of the middle column which is important for the anterior support.

## THE RESULTS OF THE POSTERIOR SURGICAL TREATMENT OF THE THORACOLUMBAR UNSTABLE SPINE BURST FRACTURES

C. KILICKAP<sup>(1)(B)</sup>, R. DANISMAN<sup>(1)(O)</sup>, V. GURKAN<sup>(1)(O)</sup>, H. GUZ<sup>(1)(O)</sup>, T. BERKEL<sup>(1)(O)</sup>

*Institution(s)*

1) 1. Ortopedi ve Travmatoloji Kliniği; Dr. Lütfü Kırdar Kartal Eğitim ve Araştırma Hastanesi, İstanbul, Türkiye

**Objectives:** We evaluated early results of treatment of patients with thoracolumbar unstable burst fractures, who underwent posterior fusion with posterior instrumentation.

**Methods:** Sixty-four patients (39 female, 25 male; mean age 38,3 years; the range of 78.12% of patients 20 to 50 years, mean follow-up 1.9 years) with thoracolumbar burst fractures who have been come to the emergency service were analyzed with their general features, and thirty-eight of them which we have been reached all of their documentation were included in this study. The reasons of the fractures were falling down (70.31 %), traffic accident (21.87) and others. We have applied of the instruments two intact vertebrae above and below the fractured segment, and we have fused one vertebra above and below the fractured segment. Frankel classification was used for neurologic status of the patients. Patients have used the thoracolumbosacral orthosis after operation, and they have got permission for walk at fifteenth day after operation with an orthosis.

**Results:** The mean of the correction of the local kyphosis angle was 8.3° at the beginning and 5.6° at the end, the correction of the sagittal index was 6.9° at the beginning and 4.8° at the end, the correction of the anterior height of the vertebrae was 23.2° at the beginning and 22.8° at the end. Four of the eight patients with aneurologic problems were got better one Frankel grade, one have got one Frankel grade worst. We haven't got any changes three of them. The results have been evaluated according to the Dennis workpain system, and 28 patients were excellent and good, 10 patients were bad (4 patients for bad neurologic status, 4 patients for infection, 2 patients for implant failure).

**Conclusion:** There is not any comparison study of the conservative treatments of the thoracolumbar unstable burst fractures of the spine, though; we believe that the development of the instrumentation and surgical techniques will be given the best surgical choice of the treatment of the thoracolumbar burst fractures.

## LONG SEGMENT POSTERIOR SURGICAL STABILISATION OF UNSTABLE THORACOLUMBAR SPINE FRACTURES

Erbil OGUZ<sup>(1)(B)</sup>, Ali SEHIRLIOGLU<sup>(1)(O)</sup>, Bahadır SEYHAN<sup>(1)(O)</sup>, Mehmet ALTINMAKAS<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Ortopedi ve Travmatoloji Kliniği; Gülhane Askeri Tıp Akademisi, 06018, Etlik, Ankara, Turkey*

Posterior reduction and stabilization is one of the most common methods in the treatment of unstable spine fractures. The purpose of this study to detect the superiority of long segment stabilization of thoracal and thoracolumbar spine fractures in the patients who have preoperatively neurological deficits.

28 patients with thoracolumbar fractures of spine with neurological deficits were surgically treated with long segment posterior stabilization technique within average 15 days from the injury between 1995 and 2001. The number of fractured vertebrae was 37. The levels of fractures between T3 and L2. The applied instrumentation system was Alici for 19 cases and Diapason for 9 cases. Average follow up period was 3 years. Rehabilitation started in the postoperatively first day.

We had 4 wound infections. Two of them treated with antibiotics and drainage of the abscess the others there were draining fistulised wound in the long term. In these cases instruments were extracted in 1 year after the surgery. In 3 cases decubitus ulcer developed. In the literature, the complications related with inst-

umentation such as dislocation of pedicular or laminar hooks, loosening of transpedicular screws, breakage of transpedicular screws, bending of transpedicular screws, breakage of rods, and loosening of telescopically nuts did not seen in our cases except dislocation of pedicular or laminar hooks. During follow-up any increasing in the kyphosis was observed.

The patients with neurological deficits need to rehabilitation for long periods. Long term immobilization causes the osteoporosis. These patients under the risk of other fractures due to secondary osteoporosis. Long segment fixation is the proper method for early mobilization of these patients. In the other hand the complications related with instrumentation such as upper junctional kyphosis and osteoporotic fractures are less then short segmented fixations.

As a result, most safe and rigid fixation for the stabilization of thoracal and thoracolumbar fractures in paraplegics can be obtained with long segment posterior stabilization. Upper segmental three level hook fixation and laminar fusion is essential for best results.

## **LATE DECOMPRESSION IN POSTTRAUMATIC SYRINGOMYELIA: A CASE REPORT WITH LONG-TERM FOLLOW UP**

**T. YAZAR<sup>(1)(B)</sup>, K.C. KOSE<sup>(1)(O)</sup>, O. CEBESOY<sup>(1)(O)</sup>, C. SOYDAN<sup>(1)(O)</sup>**

*Institution(s)*

*<sup>1)</sup> Ankara University; Faculty of Medicine, Department of Orthopaedics and Traumatology, Ankara, Turkey*

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A case report of a patient with posttraumatic syringomyelia diagnosed 14 years after the initial injury, who had undergone late decompression by an anterior approach to L2 vertebra 17 years after the initial trauma and 3 years after the clinical diagnosis of syringomyelia. Our patient's most motor and sensory symptoms resolved af-

ter the operation. This example led us to a conclusion that late decompression can be of benefit for these kinds of patients leading to recovery of both motor and sensory deficits even if performed late after the arousal of symptoms and signs of neural compression.

## MANUAL CONTOURING OF THE SPINE; A NEW TECHNIQUE FOR SCOLIOSIS CORRECTION

Ohana NISSIM<sup>(1)(C)</sup>, Iordache Sorin DANIEL<sup>(2)(P)</sup>; Klir ISRAEL<sup>(1)(O)</sup>, Sheinis DIMITRY<sup>(3)(O)</sup>,  
Sasson ALBERT<sup>(3)(O)</sup>, Soudry MICHAEL<sup>(2)(O)</sup>

### *Institution(s)*

<sup>1)</sup> Spine Surgery Unit, Rabin Medical Center, Beilinson Campus; Petach-Tiqwa, 49100, Israel

<sup>2)</sup> Department of Orthopedic Surgery, Rabin Medical Center, Beitinson Campus; Petach-Tiqwa, 49100, Israel

<sup>3)</sup> Department of Orthopedic Surgery, Soroka Medical Center; Beer-Sheva, Israel

Correction of spinal deformities such those seen in idiopathic scoliosis, are one of the challenging aspects of the spine surgeon's routine. A significant progress has made in sense of the surgical approaches, implants design and methods of correction during the last two decades. Since the pioneer conception of Paul Harrington that a scoliotic curve can be corrected by distraction, other methods such as derotation and translation came out as an alternative ways to get a straight and balanced spine. Recently, a new concept of correction for spinal deformities named in situ contouring, has brought to our attention. This method is based on a 6mm Titanium rod (SCS EuroSurgical inc.) connected to the spine with a multiple hooks and screws system. The rod is bend according to the curve in the coronal plane and loosely secure with setscrews. Following primary application of the rod, the surgeon begins to bend it manually in situ, in a contrary direction to the curve's shape. By applying a combination of a sagittal and coronal plane forces, the surgeon is able to achieve a final result of a straight and nicely balanced spine.

**Methods:** The medical records of patients with idiopathic scoliosis, who had surgery during

the last three years, were reviewed. Patients, whose operation involves using of the SCS system, enrolled into the study group. Clinical as well as radiographical data were retrieved from the hospital charts. Curves were classified according to King at eL.; measurements were taken using the Cobb's method.

**Results:** There were 10 patients in the study group (7 females, 3 males, mean age: 16.6 years). All curves were primary thoracic from which, 9 were type II and only one was type III. Mean pre-operative angle of the primary curve was 56°, mean post-operative angle was 22° with a 61 % correction rate. Patients were followed for an average period of 12 month. No complications related to surgery, correction technique, or neurological status was noted.

**Conclusions:** The in-situ contouring system has no drawbacks compare to other known methods. Our feeling is that this new technique gives the surgeon an ability to achieve the final position of the corrected spine, by a slow and gradual manipulation. This is taking a crucial advantage of the elastic property of the spine in order to get good correction and to avoid neurological complications or hooks pull out.

## **SUBLAMINAR WIRES WITH THIRD GENERATION SPINE INSTRUMENTATION FOR THE TREATMENT OF KING TYPE II AND TYPE III ADOLESCENT IDIOPATHIC SCOLIOSIS**

**Asim CILIZ<sup>(1)(C)</sup>, Suleyman PORTAKAL<sup>(1)(P)</sup>, Guray OZKAN<sup>(1)(O)</sup>, Ali UTKAN<sup>(1)(O)</sup>,  
Mehmet Ali TUMOZ<sup>(1)(O)</sup>**

*Institution(s)*

*<sup>1)</sup> Ankara Numune Hospital 2nd Orhopaedics Clinic; Opera Ankara Turkey*

In our study, we used the third-generation spine instrumentation (Hipokrat, Izmir, Turkey) and sublaminar wires for the treatment of King type II and type III adolescent idiopathic scoliosis. The aim of our study is to demonstrate the safety of sublaminar wiring, better correction and minimal loss of correction.

We report of 24 patients who underwent placement of sublaminar wires with third-generation spine instrumentation for adolescent idiopathic scoliosis from 1998 through 2001. The average age was 17 (range 14-19). There were 15 female, 9 male. The preoperative diagnosis was King type II scoliosis in 15 patients and King type III scoliosis in 9 patients. All of the patients were primary surgeries.

We evaluate the curve type, curve magnitude, number of vertebrae instrumented, level of vertebrae wired, postoperative neurologic deficit and loss of correction.

The average degree of the curves was measured as 63° (range 48-93) using the Cobb method. The average postoperative curve magnitude was 30° (range 12-48) with an average correction of 33°. The average follow-up time was 22,4 months (range 12-36 months). The total of 123 wires were placed and all of them were in the thoracic region. The average of sublaminar wiring segments was 5 (range 4-7). The average loss of correction was 2° (range of 0-6). We didn't use intraoperative spinal cord monitoring, wake-up test was performed in all patients. There were no permanent neurological sequelae in our series. We use the external support until solid fusion has been obtained. The average use of external support was 3 months.

Despite the complexity of segmental spinal instrumentation system, sublaminar wiring with third generation spinal instrumentation is safe and provides strong fixation with proper training and experience is relatively easy to apply.

## POSTERIOR INSTRUMENTATION AND INTERBODY FUSION FOR POST DISCECTOMY INSTABILITIES

Onur POLAT<sup>(1)(C)</sup>, Alihan DERİNÇEK<sup>(1)(O)</sup>, Ayhan ATTAR<sup>(1)(O)</sup>, Kemal US<sup>(1)(P)</sup>

*Institution(s)*

<sup>1)</sup> *Ankara University Ibn-i Sina Hospital; Ankara University Ibn-i Sina Hospital Orthopaedics and Traumatology Department Ankara/Turkey*

**Introduction:** Musculoskeletal complications after discectomy are intervertebral instability, kyphosis, scoliosis, lordosis and combined spinal deformity. Of these possible deformities, kyphosis and instability are most common. Also there is an increased incidence of post-operative spinal deformity in patients who have more than two lamina removed or a facetectomy performed at the time of the initial operation. There is no association between the occurrence of the deformity and sex, neurologic condition after discectomy.

**Material and Methods:** 5 patients (3 female, 2 male) underwent multilevel discectomy because of lumbar disk herniations. Their ages were 21-36 (mean age 30 years). After 6-18 months, lumbar pain developed and there were no symptom associated. From the lumbosacral x-rays (while flexion-extension and neutral), all of them had increased mobility between the ver-

tebral bodies, 4 had mild kyphosis and spondylololsthesis.

**Results:** Between June 1998-February 2000, 5 patients were underwent posterior interbody fusion and posterior instrumentation for the instability in Ibn-i Sina Hospital Orthopaedic Department. No brace treatment was used after surgery. At a mean follow up period of 20 months (range 14-25 months), 4 patient were well prognosed and there were no complication except one who had lumbar pain according to the reason of pseudarthrosis.

**Conclusion:** Spinal deformity or instability after lumbar or thoracolumbar total discectomy is not uncommon. Limiting lamina removal and facet destruction may decrease this incidence and also posterior instrumentation interbody fusion is required to correct postdiscectomy deformity and to stabilize the spine.



## MANAGEMENT OF VERTEBRAL OSTEOMYELITIS

A. GASBARRINI<sup>(1)(B)</sup>, E. BERTOLDI<sup>(1)(O)</sup>, S. BANDIERA<sup>(1)(O)</sup>, L. MIRABILE<sup>(1)(O)</sup>, F. De LURE<sup>(1)(O)</sup>,  
S. BORIANI<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Department of Orthopedics and Traumatology; Ospedale Maggiore "C.A.Pizzardi" Largo Nigrisoli  
2, 40100 Bologna*

**Background:** Mainly a retrospective study of a 49 cases of spinal infection unrelated to an open procedure on the spine, including patients with drug addiction.

**Objectives:** To analyze the results of treatment using a diagnostic and therapeutic algorithm to achieve a systematic and comprehensive approach to the management of this disease. In fact, despite advances in imaging, diagnosis of vertebral osteomyelitis is easily missed and treatment is often delayed.

**Method:** we retrospectively reviewed 49 consecutive patients aged 15-83 (average 54y) with vertebral osteomyelitis who were treated between January 1990 and March 2001. All patients received plain radiographs, gadolinium enhanced magnetic resonance imaging, Ga-67 and Tc-99 scintigraphy. A total of 29 patients underwent CT-guided fine-needle aspiration biopsy. The cultures of spinal specimen were positive in 41 % (12/29) of cases. Bacteriology and haematology factors were analysed: blood cultures were positive in 65% (13/20).

**Results:** Mycobacterium tuberculosis was the main organism followed by Staphylococcus aureus and epidermidis. All patients received intravenous antibiotics. Neurologic impairment was present in 13 (26%) patients who underwent surgery. All patients with paresis recovered completely after surgical decompression. Patients with spondylodiscitis who were treated nonsurgically, with bed rest and bracing, reported residual back pain not frequently 22% (8/36) than patients treated surgically 38%(5/13).

**Conclusion:** the outcome of patients with vertebral osteomyelitis in general is favorable when appropriate treatment is picked even if vertebral osteomyelitis is a rare condition and because of is often overlooked initially. Delay in diagnosis may results in spine impairment, more hospitalization time and more cost. We suggest diagnostic criteria in order to simplify the diagnosis.

## THORACO-LUMBAR SPINE TUBERCULOSIS: OUR EXPERIENCE IN POSTERIOR DEBRIDEMENT, RECONSTRUCTION AND INTERNAL FIXATION

Cezar POPESCU<sup>(1)(B)</sup>, Ioan POEATA<sup>(1)(O)</sup>, Radu SORETE<sup>(1)(O)</sup>, Dana TURLIUC<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Clinical Hospital no. 3; Ateneului Str. no. 2, Iasi 6600, Romania*

Tuberculous spondylitis or Pott's disease remains an important pathological entity in developing countries and its treatment controversial.

We present 9 cases of pathologically confirmed thoraco-lumbar spine tuberculosis surgically treated in our department between 1998 and 2000. There were 7 men and 2 women, ranging in age from 44 to 61 years. All patients underwent surgery: posterior debridement, autologous bone grafting and internal fixation using

transpedicular screws. The 6 patients with preoperative neurological deficit (Frankel Grades C, 2 patients; D, 4 patients) improved one grade. There was one superficial infection.

Postoperatively, all patients were immobilized in a light brace for 3 months. Fusion was obtained after 4-5 months.

We believe that surgical treatment using posterior approach is a good option for non-advanced tuberculous spinal lesions.

## TRANSPEDICULAR DECANCELLATION OSTEOTOMY IN THE TREATMENT OF POTT'S KYPHOSIS

Murat BEZER<sup>(1)(B)</sup>, Osman GUVEN<sup>(1)(O)</sup>, Kemal GOKKUS<sup>(1)(O)</sup>, Umut AKGUN<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Marmara University Hospital Department of Orthopaedics and Traumatology; Marmara Universitesi Tip Fakultesi Hastanesi, Tophaneliođlu Caddesi, No: 13/15, 81190, Altunizade-Istanbul

**Purpose:** To analyse long term functional outcome of the patients with Pott's kyphosis.

**Patients and Methods:** 16 patients with Pott's kyphosis who underwent transpedicular decancellation osteotomy with posterior instrumentation and fusion were evaluated preoperatively and post operatively with assessment of functional status by Oswestry disability index. Average age was 45.1 (27-65; SD:12.3). Radiologic assessment was made in measurement of kyphosis angle preoperatively and postoperatively. Average follow up time was 71,4 month (36-108, SD:37.14)

**Results:** All symptoms and pain disappeared in postoperative period. The preoperative average kyphosis angle 29.2° (7°-97°; SD: 22.1) decreased to average 12.2° (0°-43°; SD: 14.4). The preoperative average Oswestry disability index value 45.5 (41-50; SD:3.02) decreased to average 7.1 (3-18, 8D:4.81).

**Conclusion:** In selected cases of Pott's kyphosis, transpedicular decancellation osteotomy with posterior instrumentation and fusion could be surgical treatment of choice.

## THE SURGICAL TREATMENT OF TUBERCULOUS SPONDYLITIS AND ITS CONSEQUENCES IN ADULTS

Vaqif G. VERDIYEV<sup>(1)(B)</sup>, Rashid N. IBRAHIMOV<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Scientific Research Institute of Traumatology and Orthopedics; Scientific Research Institute of Lung Diseases, Baku, Azerbaijan*

The known methods of surgical treatment of tuberculous spondylitis as a closing stage of therapy have considerably changed outcomes of that disease. We conduct the analysis of surgical treatment of 39 patients at the various stages of tuberculous spondylitis in the age from 18 to 56 years old. The process was located in thoracic part of vertebral column at 2 (5,1 %), in thoracolumbar part - at 5 (12,8 %), in lumbar part - at 32 (82 %) patients. The availability abscess, as a complication of process, was observed at 28 (71,8 %) patients. Neurology symptoms as a radicular syndrome, the destructions of membrana spinalis, weakness in the lower extremities were notices in 29 (74,4 %) cases. At 3 (7,7 %) patients, it was marked lower paraplegia. All patients have passed the integrated examinations, including CT, MRI, Ultrasound, immunologic, bacteriological and morphological investigations. All patients before operation received a course of conservative treatment.

In according to the character and purposes all operations were unified into 4 groups:

1. Radical - restoration operations (including abscessotomy, necroctomy and resection of

body of a vertebra) were made in 22 (56,4 %) patients.

2. Reconstructive operations on anterior parts, vertebral canal and posterior elements of vertebral column were made in 6 (15,4 %) patients.

3. Correction operations were made in 2 (5,1 %) patients with the purpose of correction of deformation of vertebral column.

4. The curative-subsidiary operations (posterior osteoplastic fixation of a backbone, abscessotomy, fistulotomy) were made in 9 (23,1 %) patients.

To perform above mentioned operations we used poster lateral, anterolateral extra peritoneal and transthoracic access.

Outcomes of treatment were followed till 5 years. The good outcomes were reached at 25 (64,1 %), satisfactory - at 11 (28,2 %) patients. One patient has died by reason of thromboembolism. The neurology symptoms has passed completely in 23 (59 %), were partially restored in 13 (33,3 %) patients. Available in 2 patients paraplegia remained constant. There were not indications of a relapse at the patients, observed by us.

## THIGH ABSCESS AS A LATE COMPLICATION OF POTT'S DISEASE

Kenan BAYRAKCI<sup>(1)(B)</sup>, Bulent DAGLAR<sup>(1)(O)</sup>, Bulent Adil TASBAS<sup>(1)(O)</sup>, Mustafa SAHIN<sup>(1)(O)</sup>,  
Ugur GUNEL<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Ankara Numune Training and Research Hospital; 4th Orthopaedic and Traumatology Clinic

**Objective:** To show thigh abscess as a late complication of Pott's disease without any lumbar signs.

**Methods:** We demonstrated two patients who had thigh abscesses. Both of these patients had been operated because of psoas abscess at least one year ago. Chemotherapy was continued for 9 months. A thigh abscess was observed three and 12 months later consecutively. Neither x-rays nor pelvic ultrasonographies revealed any abnormalities in lumbar regions. A Ludloff incision was done and abscess was drained.

**Results:** Patients are symptom free and have got ten kilograms after drainage.

**Discussion:** It has to be kept in mind that, because of gravity, a psoas abscess can migrate to the thigh following tissue planes and especially in chemotherapy resistance, which is not uncommon in tuberculosis; it can recur in here after sometime. In all the cases with psoas abscess the thigh region has to be palpated and investigated by ultrasonography before the surgery. During anterior decompression of the psoas abscess surgeon has to control the inguinal canal to see if there is an abscess and thigh has to be stroked to see any pus coming through. If there is any doubt a Ludloff incision has to be done to drain the abscess in thigh, to prevent any recurrences.

## A CASE WITH LUMBOSACRAL TUBERCULOSIS

Meral CONGER<sup>(1)(B)</sup>, Mehmet TEZER<sup>(1)(O)</sup>, Banu KURAN<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Department of Physical Medicine and Rehabilitation; Sisli Etfal Education and Research Hospital, Sisli, Istanbul, Turkey*

Low back pain may arise from many different reasons which include degeneration, malignancies, infections, metabolic and inflammatory disease. A case with low back pain who turned into chronic infection is presented in this study.

A seventy years old woman presented with 5 years old history of low back pain. Radiating towards to right leg. Her pain alleviated with but did not disappear by bed rest. Clinical examination at the time of hospitalization showed reduced range of spinal extension and lateral bending but no tension signs from the sciatic nerve. Right extensor hallucis longus muscle strength was tested as 4/5 and she reported reduced sensation at L4, L5 and S1 dermatomes. Magnetic resonance imaging showed multilevel spinal stenosis bilateral S1 root indentation and partial compression of the S1 endplate. Biochemical and bacteriological blood analysis were normal. Patient complaints didn't subside with medical treatment. Five months later MRI was repeated due to left sciatic nerve irritation which was positive at L4 and accompanied with exten-

sor hallucis longus weakness of 2/5. MRI showed discitis at L5-S1 disc and anterior soft tissue involvement. Electromyographical studies pointed to chronic partial axonal degeneration of the L4-5 radices. Formerly, normal sedimentation rate was elevated to 72 mm/hr, PPD test was 20 mm., where as Gruber-Widal and Wright (with Coombs) tests were negative. Three months later anterior decompression, posterior instrumentation and fusion with allograft were performed to the patient who had required paraparesis below L2 level 10 months after being hospitalized, biopsied material when combined with clinical findings was diagnosed as tuberculosis.

Although spinal tuberculosis most usually occurs at thoracolumbar vertebrae, lower lumbar vertebrae may be involved as well. Definitive diagnosis can be made by biopsy. In cases with neurological deficit, surgical decompression and stabilization is an effective and preferred approach.

## PARAVERTEBRAL FIBROMATOSIS

Mehmet TEZER<sup>(1)(B)</sup>, Yavuz KABUKÇUOĞLU<sup>(1)(O)</sup>, Cüneyt ERKEN<sup>(1)(O)</sup>, Ünal KUZGUN<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Şişli Etfal Training and Research Hospitali. Orthopaedics and Traumatology Clinics; Şişli Istanbul

**Introduction:** Benign fibrous tumours are common. They may have a character varying from small, self limited to aggressive, invasive tumours. A paravertebral fibromatosis located just in the midline at the back is presented in this study.

**Patient history:** 59-year-old female patient noticed a swelling in her back 4 months ago. A mass was detected within the soft tissues at lower dorsal region on MRI with normal laboratory findings. Mass was hypointense in T1 weighted sequences and hiperintense in T2 weighted sequences. It was significantly visible after contrast material administration. Triple-phase bone scan revealed no metastases and the lesion

was considered as benign. Fine needle aspiration biopsy result was reported as fibromatosis or low-grade sarcoma. Wide excision was performed for treatment as the lesion was defined as a benign soft tissue mass after clinical, radiological, laboratory and histopathological findings. Histopathological study of the excised tumour mass revealed benign fibromatosis.

**Conclusion:** Fibromatosis can be seen in any localization within the skeletal system. It is a benign tumour which may also become locally aggressive and invasive. Differential diagnosis of malignant mesenchymal tumours should be done. Excision should be as wide as possible to prevent local recurrence.

## A SOLITARY OSTEOCHONDROMA IN THE SPINOUS PROCESS OF THE LUMBAR SPINE

Metin ÖZALAY<sup>(1)(B)</sup>, Sercan AKPINAR<sup>(1)(O)</sup>, Murat Ali HERSEKLI<sup>(1)(O)</sup>,  
Gürkan OZKOC<sup>(1)(O)</sup>, Reha TANDOĞAN<sup>(1)(O)</sup>

*Institution(s)*

1) Başkent University Adana Hospital; Adana

**Objective:** The objective of this study is to describe a case of a solitary osteochondroma in the spinous process of L4 and the imaging methods used for the diagnosis.

**Methods:** The clinical history, plain radiographs, bone scintigraphy, computed tomography, magnetic resonance imaging and pathologic findings of the reported patient were reviewed.

**Results:** The 13 year-old boy was treated with surgery in an attempt to remove the tumor. The intraoperative findings and the histologic examination indicated the diagnosis of a solitary osteochondroma. The result was satisfactory with no recurrence in two years period.

**Discussion and Conclusion:** Osteochondromas are the most common benign tumors of

the appendicular skeleton but they occur less frequently in the axial skeleton with an incidence of 1.3% to 4.1 %. They usually give rise to clinical symptoms during growth in the second or third decade of life. Frequently diagnosis and treatment are delayed because of poor visibility of the tumor in the column but our current patient had a palpable mass in the lumbar region. Solitary osteochondroma of the spine most frequently involve the cervical column, particularly the atlantoaxial region and rarely seen in the lumbar region. The favorite location of osteochondroma in the column is at an eccentric position in the neural arch with or without protrusion into the spinal foramen but the current case had centric position in the neural arch.



## OSTEOID OSTEOMA OF SACRUM MIMICING SACROILEITIS

Gürkan OZKOC<sup>(1)(B)</sup>, Metin OZALAY<sup>(1)(O)</sup>, Sercan AKPINAR<sup>(1)(O)</sup>,  
Murat Ali HERSEKLI<sup>(1)(O)</sup>, N. Reha TANDOGAN<sup>(2)(O)</sup>

*Institution(s)*

<sup>1)</sup> Adana Medical Center; Başkent University Faculty of Medicine Department of Orthopaedics and Traumatology

<sup>2)</sup> Ankara Medical Center; Başkent University Faculty of Medicine Department of Orthopaedics and Traumatology

**Objective:** We report the case of a 23 years old female who complained of sacroiliac pain for several months and was treated as sacroileitis.

**Methods:** The patient was suffering a continuous pain at her left sacroiliac joint for four months. She failed to respond to NSAIOs. She was first evaluated with plain radiographs, bone scintigraphy and laboratory tests (ESR, CRP, leukocyte count and bruceila agglutination test) which were reported as normal. MRI showed a non specific edema of the bone marrow at the posterior corner of the sacrum. Computed tomography showed a nidus located posteriorly at the S2 level neighboring sacroiliac joint. Pathological examination after en bloc surgical excision revealed the diagnosis.

**Results:** Surgical resection of the osteoid osteoma through a direct incision located at the sacroiliac joint brought an immediate relief of the symptoms.

**Discussion and Conclusion:** Primary tumors of the spine are relatively infrequent lesions. It was reported that, the diagnosis of osteoid osteoma in the sacrum delays compared to other sites of skeleton. In our patient the diagnosis was delayed and treated as sacroileitis. Direct radiography and MRI and even scintigraphy are not valuable for the diagnosis of osteoid osteoma of sacrum. Excision through a posterior approach is the treatment of choice. Prognosis is generally good with a low incidence of local recurrence (<10%).

## A CASE OF CHONDROSARCOMA LOCALIZED TO THE LUMBAR SPINE, SACRUM AND ILIAC WING

Ufuk AYDINLI<sup>(1)(B)</sup>, Aytun TEMİZ<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Faculty of medicine Department of Orthopaedic Surgery; Uludag University, 16059 Görükle-Bursa-Turkey

**Objective:** Chondrosarcoma of the pelvis is relatively common, comprising approximately 25% of all chondrosarcomas in most large series. In contrast, chondrosarcoma of the sacrum and spine is rare, constituting less than 5% of all cases. Because of the rare incidence of primary chondrosarcoma of the lumbar spine, we report a case of chondrosarcoma that localized to lumbar spine, sacrum and iliac wing.

**Case:** A thirty-six years old, female patient presented with pain at the lumbar region and right hip and her symptoms were progressed over 1.5 years period. During the physical examination, numbness at the L4-L5 dermatomas, motor weakness of the extensor hallucis longus and tibialis anterior muscles and positive straight leg rising test at the right side were found. Magnetic resonance imaging of the lumbosacral and pelvic areas showed a mass that originated from right side of the posterior elements and bodies of L3-S3 vertebrae and spreading to the sacroiliac joint and iliac wing at right side. There was no metastasis. Open biopsy was performed and histological diagnosis was established as the chondrosarcoma grade II. For the total re-

section of the mass, we performed hemivertebrectomy on the L2-L5 levels, partial resection of sacrum and sacroiliac joint including 1/3 of posterior part of ilium with simultaneous posterior and anterior approach. Because of the soft tissue defect, right gluteus maximus transposition flap, V-Y advancement gluteal skin flap and latissimus dorsi flap were performed. Intraoperative bleeding was approximately 8500cc and patient was observed in the intensive care unit 16 days postoperatively because of adult respiratory distress syndrome which developed in early postoperative period.

**Discussion and Conclusion:** The surgical treatment of chondrosarcoma is particularly complicated. Therefore, surgical excision of chondrosarcoma that localized to the sacrum and lumbar spine is dictated by the tumor's proximity to vital structures as well as the risk of jeopardizing axial stability. Because of these reasons, the surgical expertise required to remove axial chondrosarcomas and need careful preoperative planning and postoperative care.

## CLINICAL RESULTS OF TOTAL EN BLOC SPONDYLECTOMY FOR METASTATIC VERTEBRAL TUMORS IN THORACOLUMBAR SPINE

Munehisa KOIZUMI<sup>(1)(B)</sup>, Yurito UEDA<sup>(1)(O)</sup>, Etsuhiro MATSUYAMA<sup>(2)(O)</sup>,  
Mitsuo KUGAI<sup>(3)(O)</sup>, Takafumi YOSHIKAWA<sup>(1)(O)</sup>, Lin LIDA<sup>(1)(O)</sup>,  
Yoshinori TAKAKURA MD<sup>(1)(O)</sup>

### *Institution(s)*

<sup>1)</sup> *Department of Orthopaedic Surgery, Nara Medical University; 840 Shijyo-cho, Kashihara Nara 634-8522 Japan*

<sup>2)</sup> *Department of Orthopaedic Surgery, Tenri City Hospital; 300-11 Tomido, Tenri Nara 632-0072*

<sup>3)</sup> *Department of Orthopaedic Surgery, Tondabayashi Hospital; 1-3-36 Koyodai, Tondabayashi Osaka 584-0082 Japan*

**Objective:** Total en bloc spondylectomy (TES) introduced by Tomita has become one of the surgical interventions for the patients with metastatic tumor arising in thoracolumbar spine. The purpose of this study was to investigate the clinical results of patients who underwent TES for the metastatic thoracolumbar spinal tumor.

**Methods:** The study group consisted of the consecutive four patients with metastatic vertebral tumors in thoracolumbar spine. There were three females and one male with a mean age of 62.3 years (ranging 60 years to 65 years). The mean follow-up period was 22.5 months, ranging 11 to 38 months. The primary lesions consisted of two breast cancers, one lung cancer, and one renal cell cancer and were resected successfully before consulting to our department. All of the patients underwent TES in the procedure that Tomita introduced, which consisted with en bloc corpectomy and en bloc laminectomy combined with anterior reconstruction and posterior instrumentation. One of the patients required the anterior approach added due to the extra-vertebral tumor extension. All patients were evaluated postoperatively with plain x-rays, activity level including ambulatory period, the presence of back pain, and neurological findings.

**Results:** Postoperatively, all of the patients gained the pain relief and became ambulatory. The mean duration that the patients could walk was 18.3 months (ranging 5 to 36 months). At the time of our evaluation, one patient was alive with no recurrence of tumor and returned to job. Remaining three patients were dead and the causes of death were as follows; recurrence of lung cancer, cachexia with multiple metastases, and local recurrence of spinal lesion. The mean period from operation to death was 25 months in these three cases. There was no deterioration in neurological status except for one case with renal cell cancer who developed local recurrence.

**Conclusion:** TES has the great advantage of possible en bloc resection for the metastatic spinal tumor compared with palliative surgical interventions. On the other hand, an application of this procedure to the patients with metastatic spinal tumor is still controversial in terms of being invasive procedure and cost effectiveness. In our series, all of the patients gained the ability to walk along with pain relief and their neurological status was well maintained postoperatively. TES seemed to become one of the effective procedures to improve the quality of life in patients with metastatic spinal tumor.

## DEGENERATIVE CERVICAL SPONDYLOLISTHESIS

Fujita KYOSUKE<sup>(1)(B)</sup>, Hirabayashi HISASHI<sup>(1)(O)</sup>, Takahashi SEIKEN<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Department of Orthopaedic Surgery, Saitama Municipal Hospital; Mimuyo 2460 Saitama-shi Saitama-ken 336-8522 Japan*

**Objective:** Cervical subaxial spondylolisthesis due to rheumatoid arthritis (RA) or destructive spondyloosteoarthropathy (DSA) is sometimes observed. However, degenerative spondylolisthesis of osteoarthritic etiology is very rare. In this article, we represented 7 cases about their radiological and clinical investigation and reviewed the literature. We also discussed about their pathogenesis and results of the operated cases.

**Methods:** All patients were women, who ranged in age from 70 to 86 years old. Diagnostic studies were done by cervical plain films with flexion / extension. We evaluated the level of spondylolisthesis, degree of slippage, change of disc height and clinical symptoms. Results of the operated cases were also surveyed.

**Results:** Spondylolisthesis was found at from C3 to C5, mostly occurred at the C4 on C5

levels. Dynamic radiography showed instability at the involved level in all patients. At least 2 mm of slippage at one or more levels were existed. Maximum slippage was 7 mm. Four of the 7 patients had neurological signs and three had neck pain alone. Two of the patients with 7 mm slip required surgery.

**Discussion and Conclusion:** Spondylolisthesis is thought to be occurred at immediately above a stiff lower cervical spine. However, this theory can not necessarily be adopted in our cases. Structures and strength of posterior ligamentous complex can be related to the occurrence of slippage. Post-operative courses were good at the time of follow-up (mean 4.5 years). Instrumentation was useful for securing bone union and stability.

## THE DETERMINANTS OF SPONDYLOLISTHESIS

Hayal GULER<sup>(1)(B)</sup>, Abdullah MILCAN<sup>(2)(O)</sup>, Günşah SAHİN<sup>(1)(O)</sup>, Selda BAGIS<sup>(1)(O)</sup>,  
Canan ERDOGAN<sup>(1)(O)</sup>

### *Institution(s)*

<sup>1)</sup> Me. Ü. T.F. Fiziksel Tıp Ve Rehabilitasyon A.D.; Mersin Üniversitesi Tıp Fakültesi Hastanesi  
Zeytinlibahçe Cad Fiziksel Tıp Ve Rehabilitasyon A.D. Mersin

<sup>2)</sup> Me. Ü. T.F. Ortopedi Ve Travmatoloji A.D.; Mersin Üniversitesi Tıp Fakültesi Hastanesi  
Zeytinlibahçe Cad Ortopedi Ve Travmatoloji Kliniği Mersin

**Objective:** To assess the determinants of spondylolisthesis in middle aged women.

**Design and Methods:** We evaluated 181 patients with back pain who were diagnosed as spondylolisthesis by means of plain films of the lumbar spine. (anterior-superior and lateral radiographs). Body mass index (BMI) as a determinant of obesity and visual analog score (VAS) for pain evaluation were studied. Spondylolisthesis was graded according to Meyerding's classification.

**Results:** The mean age of patients was 59.02±9.9 years. The mean BMI was 29.07±4.8 Kg/m<sup>2</sup>. The mean VAS score was 6.1±2.5 cm. The duration of history of back pain was 6.4±6.4 years. Grade 1 spondylolisthesis was present in

47 patients, grade 2 in 33 and grade 3 only in one patient. Only 10 patients had spondylolysis (unilateral) together with spondylolisthesis on oblique radiography. The spondylolisthesis involvement was most common at L4-L5 region (49.17%) in the lumbar spine. Degenerative disk and spondylolisthesis was present in 47 (25.96%) patients.

There was a statistically significant positive correlation between VAS score and the grade of spondylolisthesis ( $r=0.170$ ;  $p=0.02$ ). There was also a significant correlation between VAS score and BMI ( $r=0.196$ ;  $p=0.02$ ).

**Conclusion:** BMI and VAS score are important determinants of patients with back pain due to spondylolisthesis.

## DIRECT REPAIR OF LUMBAR PARS INTERARTICULARIS DEFECT

Haluk BERK<sup>(1)(B)</sup>, Ömer AKCALI<sup>(1)(O)</sup>, Emin ALICI<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Dokuz Eylül University; Dokuz Eylül University, School of Medicine, Dept of Orthopedics and Traumatology, 35340 Izmir, Turkey*

**Objective:** The objective of this study is to evaluate functional outcome of patients operated on lumbar pars interarticularis defect.

**Materials and Method:** Direct repair of the pars interarticularis defect using pedicular screw hook fixation was carried out in 6 spondylolysis patients. There were 4 female and 2 male patients. The site of pars defects involved L5 in 5 cases and L4 in 1 case. Low back pain and/or radicular pain were the main symptoms, one patient presented with L5 hypoesthesia and right toe dorsiflexor motor power loss (4/5). All the patients except one were treated conservatively (dynamic lumbar stabilization exercises) prior to surgery at least for three months. Pars defects were confirmed by oblique views of the lumbosacral spine and computerized tomography taken in "reverse gantry" technique. Clinical outcomes were assessed by pre- and postoperative pain, union of the pars defects as demonstrated by CT images, functional status (SF36).

**Results:** The mean follow-up was 36.7 months (13-50 months). Implants were removed in three patients. In one patient left side implant was removed 3 months postoperatively due to intractable radicular pain. Implants were removed in two and three years postoperatively in two other patients. Follow up CT scans revealed bilateral fusion in five and unilateral fusion in one patient. Two male patients were elite sportsmen who returned to their preoperative activity level at one year postop. All but one patient were free of pain during activity. One patient had occasional pain.

**Conclusion:** We conclude that direct repair of pars interarticularis defect with pedicle screw-hook technique is feasible and effective technique. Functional outcomes are favorable. However major drawback of this study is the limited number of patients.

## THE CLINICAL IMPORTANCE OF MAGNETIC RESONANCE IMAGING IN DEGENERATIVE LUMBAR SPINE

Metin OZALAY<sup>(1)(B)</sup>, Ayşin POURBAGHER<sup>(1)(O)</sup>, Sercan AKPINAR<sup>(1)(O)</sup>, Murat Ali HERSEKLI<sup>(1)(O)</sup>,  
Gürkan OZKOC<sup>(1)(O)</sup>, Reha TANDOGAN<sup>(2)(O)</sup>

*Institution(s)*

1) Başkent University Adana Hospital; Yüreyrir Adana

2) Başkent University Ankara Hospital; Ankara

**Objective:** The objective of this study is to describe the magnetic resonance imaging features of the intervertebral discs and interspinous ligaments in relation to the patient age and low back scores. Intervertebral discs were also correlated with interspinous ligaments.

**Methods:** 37 patients (27 female and 10 male), average age 55 (34-74) who underwent lumbar magnetic resonance imaging were included in the study. Patients were examined clinically by use of the Japanese Orthopaedic Association's Evaluation System for lower back pain syndrome (JAO Score).

**Results:** Type 1B (normal disc height with dehydration) disc was predominated at L4-L5 and L5-S1 ( $p=0.000$ ,  $p=0.002$  respectively). Type 1A (low intensity on T1- and T2- weighted images without hypertrophy of the spinal process) was predominated at L3-L4 and L4-L5 interspinous ligament ( $p=0.001$ ,  $p=0.000$  respectively). Type 3 (high intensity on both T1- and T2- weighted images) was predominated at L5-S1 interspinous ligament ( $p=0.000$ ). Negative correlation was found between age and JAO Score. L5-S1 disc degeneration was decreased with increasing JAO scores. There was positive correlation between L3-4 and L4-5 interspinous ligaments changes.

There was no correlation between disc degeneration and interspinous ligament changes.

**Discussion and Conclusion:** The number of patients seen by orthopaedic surgeons for degenerative conditions of the lumbar spine is increasing. Imaging studies are an integral part of the evaluation of the patient with signs and symptoms of lumbar spine disorder.

The latest modality used to evaluate the spine is MR imaging. Degenerative changes occur in the intervertebral disc, facet joints and spinal ligaments. Although MRI has been used to evaluate disc degeneration, not much is known about the correlation between MRI findings of interspinous ligament and disc in degenerative spinal disease. In the previous studies, Type 2 ligament was found mostly at L4-5 interspinous level which is generally regarded as the most unstable motion segment at the lumbar spine but in our study, Type 1A ligament was found mostly at L4-5. At L5-S1 interspinous level, Type 3 ligament was found mostly in our study although L5-S1 level is more stable than L4-5 because of the iliolumbar ligament and the deep-seated location below the pelvis. MRI may be helpful in assessing normal and pathologic changes in disc and interspinous ligament.

## INDIVIDUAL AND OCCUPATIONAL DETERMINANTS OF LOW BACK PAIN ACCORDING TO VARIOUS DIAGNOSIS OF LOW BACK PROBLEMS

Gül BALTACI<sup>(1)(C)</sup>, Nevin ERGUN<sup>(1)(P)</sup>, Ayşenur BESLER<sup>(1)(O)</sup>, Volga Bayrakçı TUNAY<sup>(1)(O)</sup>,  
Magsoud EIVAZI<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Hacettepe University; School of Physiotherapy and Rehabilitation Sports Physiotherapy Unit  
06100 Ankara Turkey

The purpose of this study was to investigate the prevalence of back pain in general population aged between 16 and 86 years. A retrospective chart review analysis with recent follow-up was performed on 443 patients diagnosed by orthopaedic surgeons from different hospitals through clinical examination and plain radiographs from 1991 to 2002. 36 building problems, 38 protrusion problems, 46 patients with herniated lumbar disc, 56 patients with spondylolysis, 129 patients low back pain, 96 patients with lumbar strain, 21 patients spinal stenosis, 11 patients with facet fracture, 5 patients with spina bifida, 5 patients with scoliosis were attended to physiotherapy and rehabilitation in sports physiotherapy unit at various sessions. Data were compiled on 443 patients (221 men and 222 women) with changes in functional physiotherapy examination and evaluations. We report age standardized prevalence estimates stratified by age, gender, occupation and spinal pain severity. Questionnaire data on 78 men (35% non-working) and 98 women (44% non-working) gat-

hered over the period 11 years. Larger differences were found for chronic low back problems, and activity limitation and use of health services due to low back problems. When those unable to work because of disability (work disabled) were excluded, the prevalence and consequences of low back pain were still higher in the non-working group in comparison with the working population. Most of the non-working women are housewives and this group was both large in size and had a high prevalence of low back problems. Psychosomatic problems, bending or carrying loads were often associated to low back pain, whereas other risk factors were related some specific dimensions of the disorder. Among the men studied, more than a quarter of total burden of low back problems in those aged 20-59 years were found in the non-working population, among women this was 50%. Both research on causes and determinants of low back pain and the development of preventative actions should also be translated to the non-working population.



## PERCUTANEOUS DISC DECOMPRESSION USING NUCLEOPLASTY

Lewis SHARPS<sup>(1)(B)</sup>

*Institution(s)*

<sup>1)</sup> *Orthopaedic Surgery and Sports Medicine; P.O Box 968, Paoli, PA 19301 U.S.A*

**Objective:** The objective of this study is to illustrate the effectiveness of Nucleoplasty<sup>TM</sup> (ArthroCare<sup>®</sup> Corporation, Sunnyvale, CA), a minimally invasive procedure for disc decompression which has been developed to treat symptomatic patients with contained herniated discs. This is a prospective, non-randomized, single center study.

**Methods:** A total of forty-eight patients underwent the Nucleoplasty procedure. Nine of these patients had prior surgeries. Four patients had prior fusions, four had prior percutaneous disc procedures, and one patient had undergone a prior lumbar laminectomy. Questionnaires were filled out pre-procedure, and at one month, three months, six months and one year post-procedure. A Visual Analog Scale (VAS) was administered to measure pain symptoms at all visits. The procedures were done on an outpatient basis under local anesthesia with a 17 -gauge introducer needle inserted through the annulus and into the nucleus. As part of the standard protocol for interventional spinal procedures, patients were placed on a routine rehabilitation program.

**Results:** Forty-eight out of forty-eight patients have been followed for one month, with

thirty-eight followed for three months, twenty-four followed for six months and eleven patients followed at twelve months. The mean age was 38 years old, with ages ranging between 30-61 years old. No post-surgical complications were recorded. The mean VAS scores at the time of surgery were 7.9, 3.7 at one month, 3.4 at three months, 3.3 at six months, and 4.2 at twelve months. Success is measured by a minimum 2-point reduction on the VAS scale, patient satisfaction and absence of narcotic usage. Overall, there was a 79% success rate. In the group that had previous surgery, the success rate was 67%, versus 82% in the group that had no previous surgical intervention.

**Discussion and conclusions:** These results indicate that Nucleoplasty is a promising and efficacious minimally invasive procedure for the treatment of symptoms associated with contained herniated discs. No adverse events have been observed in patients enrolled to date in this study. There was a substantial decrease in post-procedure VAS scores. Although long-term data are not available, initial data indicates that the Nucleoplasty is a promising option for symptomatic patients with contained herniated discs.

## NUCLEOPLASTY: A NOVEL APPROACH TO PERCUTANEOUS DISC DECOMPRESSION

Robin D. MCMAHON<sup>(1)(O)</sup>, Duran N. YETKINLER<sup>(1)(B)</sup>,  
Norman R. SANDERS<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> ArthroCare; 680 Vaqueros Avenue, Sunnyvale, CA 94085 U.S.A

Several techniques have been used successfully to achieve Percutaneous disc decompression for back and radicular pain over the last several decades. Chemonucleolysis uses chymopapain to decompress disc enzymatically, automated percutaneous Lumbar discectomy (APLO) using the Nucleotome and Percutaneous laser disc decompression (PLDD) have also been performed with reported successes. Nucleoplasty, uses Coblation technology (ArthroCare® Corporation) to percutaneously decompress contained herniated discs, and is the newest addition to current practices. Nucleoplasty employs Coblation technology by using the common technique (discogram) of inserting a needle into the annulus of the herniated disc. The needle remains intact within the outer annulus and allows the minimally invasive thoroughfare for Coblation to be introduced into and ablate the tissue for decompression. Tissue ablation is achieved at temperatures of approximately 40-70°C, thereby thermal damage to surrounding tissue is minimized. The procedure is performed under local anesthetic, with flu-

oroscopic guidance and done on an outpatient basis. To date, there have been no known adverse events reported. Clinical results up to one-year post procedure have revealed a substantial reduction in patient's pain and narcotic usage, as well as high overall patient satisfaction ratings. Although patients with a variety of symptoms report satisfaction with the procedure, recent clinical data reveals that the greatest clinical benefits are being reported by patients who's leg pain is greater than or equal to their back pain, patients who have a contained disc protrusion as evidenced by MRI, and a failed selective nerve block. Patients with severe degenerative disc disease, disc extrusion or moderate to severe spinal stenosis are proving less likely to benefit long term from the procedure. Information learned from clinical data has helped better understand the most appropriate patient selection criteria for optimum results. One-year clinical data confirms the benefits and safety of the procedure. Further investigation is necessary to understand the procedure's benefits long-term.

## LONG TERM RESULTS OF WIDE LAMINECTOMY FOR LUMBAR SPINAL CANAL STENOSIS WITHOUT FUSION

Atsushi IWATA<sup>(1)(B)</sup>, Masahiko MATSUSAKI<sup>(1)(O)</sup>, Kohei TAKATA<sup>(1)(O)</sup>, Mitsuo OCHI<sup>(1)(O)</sup>,  
Tadahiko YOTSUMOTO<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Department of Orthopaedics, Shimane Medical University; 89-1 Enyacyo, Izumo, Shimane, Japan*

**Introduction:** Laminectomy for lumbar canal stenosis (LCS) causes instability due to the loss of posterior components of the vertebral column. In this study, we followed patients who underwent laminectomy without fusion and investigated prognostic factors for surgical outcome.

**Materials and Methods:** 58 patients underwent laminectomy without fusion for the treatment of LCS were followed for more than ten years. Age at the time of surgery ranged from 43 to 77 years. The length of follow-up ranged from 10 to 17 years. The following items were investigated: number of excised vertebral laminae, intervertebral mobility, and preoperative intervertebral joint morphology, et al. Clinical results were assessed using Japanese Orthopedic Association (JOA) scores.

**Results:** The average degree of improvement in JOA scores was 54.2%. That for patients in

whom one lamina was excised was 69.7%, two laminae (40.3%) or more (27.6%). In addition, the average improvement degree in JOA scores for patients with more than 10 degrees of intervertebral mobility was 49.2%, while that for those with less than 10 degrees was higher, at 78.6%. The degree in JOA scores for patients with W-type intervertebral joint was 39.2%, whereas that for those with M-type joint was higher, at 54.2%.

**Conclusions:** Surgical outcomes were favorable more than ten years after undergoing laminectomy. Nonetheless, these were affected by many factors, such as the number of excised laminae, range of intervertebral mobility, and joint morphology. These findings support the notion that laminectomy leads to instability due to the loss of posterior components.

## BED REST PREVENTS COLLAPSE OF THE LUMBAR VERTEBRAL BODY IN CASE OF POSTOPERATIVE SINKING OF TITANIUM THREADED FUSION CAGE

Kosuke KURIBAYASHI<sup>(1)(B)</sup>

*Institution(s)*

<sup>1)</sup> *Department of Neurosurgery, Tanabe Central Hospital; 27 Tanabe Hirata, Kyotanabe 610-0331 Japan*

**Objective:** Titanium threaded fusion cages are commonly used in surgery for degenerative lumbar spine disease. Non-unions are few, but the cages sometimes slip into the spinal canal due to collapse of the vertebral body. I present how to avert the lumbar vertebral body collapse when sinking of titanium threaded fusion cage occurred in early postoperative period.

**Methods:** Since 1997 I have done the posterior lumbar interbody fusion using titanium threaded fusion cages without pedicle screw systems at 338 levels in 219 patients; 133 men and 86 women. Ages ranged from 18 to 87 (mean 53.5) years. One hundred and twelve patients had one level fused, 95 had two levels and 12 had three levels.

**Results:** Satisfactory disc height was restored and the symptoms improved in all

patients but four. Sinking of the cage occurred in these four patients 7 to 17 days after operation. In a 67 -year-old man the cage placed on the right side at L4-L5 showed a slight sinking 12 days postoperatively. He had no symptoms, and was allowed ambulatory. In 2 months the cage was found entirely into the canal. He was reoperated. Three other patients (67,73 and 73 years old) had minor sinking, and one of them had an accompanying pain. They were treated with bed rest for one month. No further sinking occurred, and solid union was achieved in all patients.

**Discussion and conclusions:** Sinking of a cage with collapse of the vertebral body could occur within 3 weeks after surgery. Immediate bed rest for one month will do and solid union will be achieved.

## LONGITUDINAL LENGTH OF THE SPINAL CORD AFTER CERVICAL LAMINOPLASTY

Toni YOKOYAMA<sup>(1)(B)</sup>, Aldhiro OKADA<sup>(1)(O)</sup>, Takashi TOMITA<sup>(1)(O)</sup>, Kazunari TAKEUCHI<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Department of Orthopedic Surgery, Hirosaki University; 5-Zaifu-cho, Hirosaki, Aomori, Japan*

**Introduction:** In cases of cervical myelopathy, the relationship between surgical outcome after laminoplasty and the sagittal alignment is controversial. In our cases with unexpected poor surgical outcome, we often found a straight, tense spinal cord on postoperative MRI. So we tried to measure a longitudinal length of the cervical spinal cord (LSC) as a new parameter. The purpose of this study is to prove our hypothesis that an increase of LSC after cervical laminoplasty may be a risk factor for poor surgical outcome.

**Methods:** Thirty-six patients (24 male and 12 female) with cervical myelopathy were operated on at the age from 33 to 76 (average 59y/o). The follow-up period was from 12 to 86 months (average 39 months). There were 25 patients in the laminoplasty group (group LP) (13 cervical spondylotic myelopathy (CSM) and 12 ossification of posterior longitudinal ligament (OPLL) and 11 in the anterior fusion group as control (group AF) (8 CSM and 3 OPLL). There were no significant differences in the age, sex and follow-up period between two groups. We evaluated surgical outcome with the recovery rate of scoring system for cervical myelopathy of Japanese Orthopedic Association (JOA score). We used the sagittal T2 weighted MRI, and computed LSC that was a summation of the distance of each spinal cord midpoint at intervertebral line between the C1 upper line and the T1 vertebral upper line. We defined the LSC gap as the subtraction value from preoperative to last follow-up LSC. A plus quantity of LSC gap represents an increase of LSC after surgery. Mann-Whitney U test was used statistically and P values less than 0.05 were considered statistically significant.

**Results:** In the group LP, LSC gaps ranged from -21 mm to +4mm (average -1.0, standard de-

viation; SO 4.9mm). In the group AF, LSC gaps ranged from -5mm to +7mm (average 0mm, SO 3.4mm). There was no significant difference in LSC gaps and recovery rate between the 2 groups. In the group LP, 7 cases (28%) had under -2mm LSC gaps and 6 cases (24%) had over +2mm LSC gaps, and recovery rate in 7 cases under -2mm LSC gaps ranged from 13% to 67% (average 47%) and in 6 cases over +2mm LSC gaps from -200% to 20% (average -53%). There was a significant difference between the cases under -2mm LSC gap and the cases over +2mm LSC gap (P=0.025). Of 6 cases over +2mm LSC gap, 5 cases had straight alignment and 5 cases had OPLL. In the group AF, 4 cases (36%) had over +2mm LSC gaps and recovery rate in the 4 cases ranged from 0% to 100% (average 75%). There was a significant difference between 6 cases over +2mm LSC gaps in the group LP and 4 cases over +2mm LSC gaps in the group AF (p=0.049).

**Discussion:** Chiba proposed a new concept that the shortening in the longitudinal distance of the cervical spine caused by multiple disc space narrowing may have a certain impact on the postoperative results. We agreed with their hypothesis, because of our first result that the patients with over +2 mm LSC gaps had worse surgical outcomes than with under -2 mm LSC gaps. Moreover, 5 of the 6 cases with over +2 mm LSC gaps had OPLL and straight alignment. From the second result, anterior mass and dynamic motion played important roles in impeding the neurological recovery in the cases over +2mm LSC gaps.

**Conclusion:** An increase of the longitudinal length of the spinal cord after cervicallaminoplasty is a risk factor for poor surgical outcome.

## **SURGERY FOR PATIENTS WITH BOW HUNTER'S STROKE: USEFULNESS OF INTRAOPERATIVE HEAD ROTATION**

**Michihiro KOHNO<sup>(1)(B)</sup>, Hiromu SEGAWA<sup>(1)(O)</sup>, Keiji SANO<sup>(1)(O)</sup>**

*Institution(s)*

*<sup>1)</sup> Department of Neurosurgery, Fuji Brain Institute & Hospital; 270-12, Sugita, Fujinomiya city, Shizuoka prefecture, 418-0021, Japan.*

**Introduction:** For patients with the rare condition of Bow Hunter's Stroke, which causes vertebrobasilar insufficiency due to narrowing of the upper cervical vertebral artery (VA) upon rotation of the head, some kinds of operations have been reported and the treatment hasn't unified yet.

**Methods:** We operated on four patients with bow hunter's stroke. Every patient showed narrowing of VA at the level of C2 transverse foramen, on the side opposite to the direction of head rotation. Most patients showed hypoplasia of the other VA and posterior communicating arteries. In every operation, opening of single C1 transverse foramen and freeing of VA without touching C2 structures was done, and backward mobility of VA was confirmed during intraoperative head rotation. We placed a pedicled fat graft on the freed VA to prevent postoperative adhesion.

**Results:** In all of the four patients, the symptoms associated with head rotation were completely resolved postoperatively and no symptom recurrence was recognized in the follow-up period (mean: 3 years and 3 months). Also, no postoperative VA occlusion / stenosis caused by adhesional entrapment occurred.

**Discussion and Conclusions:** We consider that the C2 level narrowing of VA is caused by stretching of VA associated with forward migration of C1 transverse foramen during head rotation. Therefore, opening of single C1 transverse foramen and freeing VA is considered sufficient to resolve the C2 level narrowing of VA, and in this series gave excellent operative results. Confirming the effects of surgery for Bow Hunter's stroke using intraoperative head rotation is considered very useful and important.

## SPONDYLOLYSIS OF LUMBAR SPINE IN ATHLETES: COMPARISON OF TWO DIFFERENT NONOPERATIVE TREATMENTS

Gul BALTACI<sup>(1)(B)</sup>, Nevin ERGUN<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Hacettepe University; School of Physiotherapy and Rehabilitation Sports Physiotherapy Unit  
06100 Ankara- Turkey

The purpose of this study was to compare the results of two different nonoperative treatments for athletes with spondylolysis of the lumbar spine. A retrospective study with recent follow-up was performed on 56 patients treated with conventional physiotherapy (36 patients) (Group 1) and manual therapy (20 patients) (Group 2). All of the patients were involved in sports at first onset of symptoms. Activities involving repetitive hyperextension and/or extension rotation of the lumbar spine were described as painful in 98% of the patients. In Group 1, 26 (72%) had an L5 defect and 10 (28%) an L4 defect. 18 patients had bilateral defects, and 18 had unilateral defects. In Group 2, 12 (60%) patients had an L5 defect and 8 (40%) and L4 defect. 12 had bilateral defects and 8 had unilateral defects. Group I received conventional physi-

otherapy including infrared lights, ultrasound therapy, and interferential therapy and home exercise program and Group 2 manual therapy involving mobilization and manipulation techniques according to Cyriax and dynamic stabilization exercises. Average treatment sessions were 20.88 days for Group 1 and 10.65 days for Group 2. Average follow-up was 1.8 years. In Group 2, 18 (90%) had excellent results, two had good results. In Group 1, 22 (71 %) had excellent results, eight (22%) had good results, four had fair results, and two had poor results. Based on our results, we postulate that a course of nonoperative treatment including mobilization and manipulation may be effective, successful and safe for the treatment of spondylolysis.

## ACCIDENTAL PEROPERATIVE LUMBAR DUROTOMY - FORTY DURAL TEARS OUT OF 842 OPERATIONS

Francois DUBUC<sup>(1)(B)</sup>

*Institution(s)*

<sup>1)</sup> *Hopital Brome-Missisquoi-Perkins; 950, Principale, Cowansville (Quebec) Canada, J2K 1K3*

469 patients sustained 842 operations at their lumbar spine in the course of the last 15 years such as discectomy, decompressive laminectomy with or without grafts and with or without instrumentation.

Forty dural tears (durotomy) occurred with injury to the root or its rootlets in 6 patients. Three developed an LCR fistula and had to be reoperated at 7; 13 and 16 days post original operation. Root or rootlets sectioning occurred in 0,5% and overall accidental durotomy in 4,76%.

The durotomy occurred at a first operation 19 times (4%), a second operation 13 times (5,7%), a third 5 times (5,9%), a fourth 3 times (7,7%) and not with the 12 patients who were at their fifth low back operation. Average age of these 40 patients was 47,1 years 25 being men and 15 females.

Occurrences were during the hernia dissection to free it from the root, followed by the use of the Kerrison rongeur to remove the ligamentum flavum or the lamina. Five injuries occurred during wiring or screw placement. Discs were found to be sequestered in 23 patients (no stenosis in 6 and having to have a laminectomy in 17).

The root involved was:

L5	18 (45%)
S1	8 (20%)
L4	4 (10%)
Above L4	3 (7,5%)

At a subsequent operation in 5 patients, a pseudomeningocele was found and repaired without having identified a cerebro-spinal fluid leak at the previous operation.

Types Of Operations In The 842 Done						
	D	S	G	L	Pout	Ant
First 469 (55.7%)	176	131	79	69	-	14
Second 229 (27.2%)	57	29	60	43	29	11
Third 93(11%)	9	4	22	31	24	3
Fourth 39 (4.6 %)	3	-	11	9	16	-
Fifth 12 (1.5%)	1	2	1	3	5	-

D=Discectomy, S=Sequestrum, G=Graft with or without instrumentation, L=Laminectomy as the principal procedure, Pout=Removal of Roy-Camille plates, Ant=Trans-peritoneal anterior graft.



## INTRASPINAL METALLOSIS AS A CAUSE LATE PERIOD PARAPARESIS SECONDARY TO POSTERIOR SPINAL INSTRUMENTATION

Mehmet TEZER<sup>(1)(B)</sup>, Ünal KUZGUN<sup>(1)(O)</sup>

*Institution(s)*

*<sup>1)</sup> Şişli Etfal Training and Research Hospitali. Orthopaedics and Traumatology Clinics; Şişli /  
istanbul*

**Introduction:** Metallosis is not a rare situation after orthopaedic surgeries in which implantation takes place. It is seen especially when massive steel implant materials are used. But it has been rarely reported after spinal instrumentations.

**Patient history:** 57 years old male patient was admitted to our clinic after fall from high. He underwent posterior spinal surgery with pedicle screw-hook combination system made of steel with a diagnosis of T8-9 compression fracture. In early postoperative period no clinical or radiological abnormality was detected. Patient went out of follow-up and attended some other physicians for the following three years without any abnormality. He performed his daily activities and continued doing his job. In the end of third year, progressive paraparesis has developed beginning in the left lower extremity first. In the last follow-up deep tendon reflexes were found to be increased with muscle strength of 2-3. X-rays

revealed caudal migration of pedicle hook in T6. MRI, CT, EMG and myelography were all performed and distinguished an intraspinal mass at the level of T6. Intraoperative findings, in which material extraction, exploration, and decompression were performed, included the metallosis around left T6 pedicular hook. This intraspinal mass which made the medullary canal severely narrower was pushing spinal cord to the opposite side and anteriorly. All the instruments and space occupying mass were extracted. Patient showed a progressive increase in muscle strength (4) in 6 months after the surgery.

**Conclusion:** Intraspinal metallosis is not frequently seen after spinal surgery. Although intraspinal metallosis due to laminar hooks is present in literature, our case is unique for it being the first case as intraspinal metallosis secondary to pedicular hook placed far from the medullary canal.

## THE EFFECTS OF HAEMOSTATIC AGENTS ON GRAFT DONOR SITE

Erol YALNIZ<sup>(1)(B)</sup>, Selcuk ERCAN<sup>(1)(O)</sup>, Misel KOKINO<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Trakya University; Medical School. Department of Orthopaedic Surgery 22030 Edirne Turkey*

**Objective:** The purpose of the study is to investigate the effects of haemostatic agents on donor site in spinal surgery.

**Methods:** A prospective clinical study was carried out in a group of 53 patients who underwent spinal operations at Trakya University Hospital. Bone wax and curaspon were used as haemostatic agents. The patients were divided into 4 groups. We applied bone wax in 17 patients (group 1) and curaspon in 14 (group 2). In 12 patients donor site was covered with curaspon for 5 or 10 minutes then removed (group 3). No agent was used in 10 patients (group 4). The age, sex and diagnosis of the patients and shape of incision were not taken into consideration. In 27 patients, donor site were exposed from the main incision and in 26 patients separate incision were performed. Closed suction drainage system were used for 48 hours or until the amount of drainage below 30 cc daily.

**Results:** In group 1 the amount of drainage was 6.6 cc, in group 2 12.8 cc, in group 3 10.3 cc and in control group 18.6 cc per 1 cc bone graft. The difference between study and control groups was statistically significant ( $p < 0.5$ ) except group 3 ( $p > 0.5$ ). Also the difference between group 1 and 2 was statistically significant

( $p = 0.17$ ). We haven't seen any complication such as infection or delayed wound healing related to haemostatic agents. There is no statistically significant differences between the using same or separate incision ( $p > 0.5$ ).

**Discussion:** In spinal surgery, autogenous bone grafts improves fusion. On the other hand the potential exists for morbidity at the donor site. After removing cortical and cancellous bone, outer surface of iliac bone remains open, and bleeding continue after wound closing. Hematoma is one of the reason for donor site morbidity. It may be responsible for donor site pain postoperatively, delayed wound healing and infection. Using haemostatic agents and closed suction drains prevent this complication. Both curaspon and bone wax are foreign materials. Although bone wax is said to retard bone healing, and curaspon in large amounts has been associated with sterile serous drainage from wounds, we haven't seen any complications such these.

**Conclusion:** Our study demonstrates that bone wax and curaspon are reliable and effective haemostatic agents to diminish amount of drainage from the iliac donor site in spinal surgery. In comparison to curaspon bone wax shows better haemostatic effect.

## DIFFERENT CONTINUOUS TOTAL INTRAVENOUS ANESTHESIA TECHNIQUE IS RECOMMENDED FOR WAKE-UP TEST (A PRELIMINARY STUDY)

Riza KURUEFE<sup>(1)(B)</sup>, Aysun YILMAZLAR<sup>(1)(O)</sup>, Berrin OZCAN<sup>(1)(O)</sup>, Ufuk AYDINLI<sup>(2)(O)</sup>,  
Cagatay OZTURK<sup>(2)(O)</sup>

### *Institution(s)*

1) Faculty of Medicine, Department of Anesthesiology and Reanimation; Uludag University, 16059 Görükle-Bursa- Turkey

2) Faculty of Medicine, Department of Orthopaedic Surgery; Uludag University, 16059 Görükle-Bursa-Turkey

**Objective:** Total intravenous anesthesia (TIVA) is one of the most recommended anesthetic method for wake-up test.

**Methods:** Thirty-eight (8 males, 30 females, ASA class I-II patients whose ages ranged 9-31 years, weight ranged 20-85 kg) scoliosis surgery cases were received TIVA consist of midazolam, mivacurium, alfentanil infusions. Infusion rates very rapid intraoperative neurological examination without pain and no complication related to the test was observed

**Discussion and Conclusion:** Authors concluded that decreasing infusion rates of total int-

ravenous were decreased in each surgery phase until wake-up (Table-1)

At the surgeon's request midazolam and mivacurium infusions were discontinued, flumazenil was given, patients were asked to move hands and feet.

**Results:** The median intraoperative wake-up times were 5.7 minutes. The protocol the authors set up allowed a anesthetics until wake-up test seems to be a safe and practical method. This report describes preliminary experience with this technique.

INFUSION	PHASE 1 (EXPOSURE)	PHASE 2 (INSERT)	PHASE 3 (RODIMPLANTATION)	PHASE 4 (CORRECTION)	PHASE 5 (WAKE-UP)
Midazolam (mg/kg/hour)	0.3	0.225	0.15	0.075	0
Mivacurium (mg/kg/hour)	0.5	0.375	0.25	0.125	0.03
Alphentanyl (mg/kg/hour)	0.03	0.03	0.03	0.03	0.03

## A CHANGE IN BLOOD FLOW OF THE SPINAL CORD ARTERY DUE TO THE CERVICAL LAMINOPLASTY

Koji SATO<sup>(1)(B)</sup>, Toshihiro ANDO<sup>(1)(O)</sup>, Kazuyoshi MIYASAKA<sup>(1)(O)</sup>,  
Yukihiro MATSUYAMA<sup>(2)(O)</sup>, Taichi TSHUJI<sup>(1)(O)</sup>

### *Institution(s)*

- <sup>1)</sup> Department of Orthopedics, Nagoya Daini Red Cross Hospital; 2-9, Myouken-cho, Shouwa-ku, Nagoya, 466-8650, Japan
- <sup>2)</sup> Department of Orthopedics, Nagoya University School of Medicine; 65, Thurumai, Shouwa. 466-8550, Japan

**Objective:** We usually operate cervical laminoplasty for cervical myelopathy due to canal stenosis. On that occasion, as for the decompression of the spinal cord, it can be confirmed by the intraoperative ultrasonography. But, all the reports about a change in blood flow of the spinal cord are nothing. It considered how the blood flow of the spinal cord changed at the time of the cervical laminoplasty.

**Methods:** Since August 2001, we were performed 30 operations for laminoplasty (Kurokawa method modified bilateral open door). They are 19 cases of men, 11 cases of women and the average age 61 years old. Before both openings lamina, an anterior spinal artery was examined about nineteen cases that it could be measured. After the processus spinosus of C3 to 7 was removed, then central groove was dug, and a anterior spinal cord artery was observed for the sagittal with the ultrasonography. An anterior spinal cord artery was visualized with Power

Doppler, and PI (Pulsatility index) and RI (Resistance index) were measured with Pulse Doppler. After lamina opened, we measured again PI and RI.

**Results:** A spinal cord was decompressed favorably as to every case, and the visualization of the anterior spinal cord artery turned good. PI and RI which become the index of the blood flow due to the decompression decreased from 1.67 to 1.34. RI decreased from 0.60 to 0.53.

**Discussion and conclusion:** The absolute value of consideration PI and RI takes an influence in the blood pressure and the age as well. Though generally a decrease in vascular resistance can't be said as the increased vascular flow again, it can be said that PI and RI show a tendency to decrease due to the decompression. It confirmed that the blood flow of the spinal artery right after the laminoplasty changed in the increase tendency.

## INTERLAMINAR OSTEOTOMY IN SURGICAL CORRECTION OF THE KYPHOSIS OF ANKYLOSING SPONDILITIS (AS)

H. KUTLU<sup>(1)(B)</sup>, E. MERIH<sup>(1)(O)</sup>, F. HATIPOGLU<sup>(1)(O)</sup>, K. CETINER<sup>(1)(O)</sup>, O. ORTAL<sup>(1)(O)</sup>, A.N. KARA<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> *Orthopaedics and Traumatology Clinic; Vakıf Gureba Hospital, Istanbul, Turkey*

In ankylosing spondylitis the fixed kyphosis of the spinal column is the resulting deformity in general. Pain and inability of the physical outcome are the main complains of the patients. Surgical correction is the only choice of the treatment in this type of deformity.

Interlaminar osteotomy is one of the surgical techniques used in surgical correction of AS. This technique was applied in three patients in our clinic in 2000. All the patients were male, aging 22, 30, 31 years and all had thoracolumbar kyphosis of major lumbar kyphosis. Multilevel interlaminar osteotomy was performed from T12 to S1. Restoration of lumbar lordosis was achieved by pushing the column to fracture the

ankylosis between the corpus vertebrae to close the osteotomized space up to sitting of upper vertebrae to adjacent one. Stabilization was performed by posterior transpedicular fixation from T11 to S1. Although it was simple and easy technique, the surgeon must keep in mind the dural adherence and rather long lasting surgery time, the mean was 6 hours in our cases. We had no complication both intraoperatively and post operatively. The patients were mobilized in the 2nd day of operation.

After the mean of 1.5 years of follow up, the patients have full activity and both physical and psychosocial results are excellent.

## SURGICAL TREATMENT OF CERVICOTHORACIC PATHOLOGIES

**Sukru CAGLAR<sup>(1)(B)</sup>, Ayhan ATTAR<sup>(1)(O)</sup>, Ali O. TASCIOGLU<sup>(1)(O)</sup>, Ahmet ERDOGAN<sup>(1)(O)</sup>,  
Tarık YAZAR<sup>(2)(O)</sup>**

*Ins titution(s)*

<sup>1)</sup> *Department of Neurosurgery; University of Ankara, Medical School, Ankara, Turkey*

<sup>2)</sup> *Department of Orthopaedics; University of Ankara, Medical School, Ankara, Turkey*

Surgical Access to cervicothoracic junction pathologies is one of the common problems in spinal surgery, especially if the lesion compromise spinal canal. The surgical approaches to this region have been traditionally divided into anterior, anterolateral, posterolateral and posterior approaches. Posterior approaches, such as laminectomy are applied frequently and are well known by all neurosurgeons. However laminectomy provides poor exposure to the anterior vertebral elements and, access to ventral pathologies through laminectomy may be difficult.

In our series, 10 patients with profound neurological deficit, and 2 patients with pain underwent anterior, anterolateral or posterolateral approaches. 6 patients with neurological deficit

and 2 patients with pain underwent laminectomy through posterior approach, and 1 patient with neurological deficit underwent combined (anterior and posterior) approach. The results suggest that corpectomy, spinal cord compression and spinal stabilization with anterior, anterolateral and posterolateral approaches can improve the quality of life considerably in patients with spinal lesions by restoring or preserving ambulation and by controlling intractable spinal pain with acceptable rates of morbidity and mortality. The patients who underwent solely laminectomy may develop progressive deformity. However, appropriate choice of surgical approach depends on the exact location of the pathologic process.

## **COST AND EFFECTIVENESS ANALYSIS OF MANUAL THERAPY AND PHYSIOTHERAPY FOR LOW BACK AND NECK PAIN**

**Gül BALTACI<sup>(1)(B)</sup>, Volga Bayrakçı TUNAY<sup>(1)(O)</sup>, Nevin ERGUN<sup>(1)(O)</sup>, Aysenur BESLER<sup>(1)(O)</sup>, Magsoud EIVAZI<sup>(1)(O)</sup>**

*Institution(s)*

*Hacettepe University; School of Physiotherapy and Rehabilitation 06100 Ankara Turkey*

A randomized, clinical trial was conducted in which patients with back/neck problems, visiting an orthopaedic and neurosurgeon, were allocated to manual therapy or physiotherapy as primary management. The aim of the study was to compare outcome and costs of the effects of two-treatment techniques-manual therapy and physiotherapy- in managing patients with low back and neck pain. Earlier studies on the treatment of back pain by spinal manipulation have shown inconsistent results. Two hundred forty-four patients with neck pain and four hundred forty-three patients with low back pain aged 18-65 years who had not been treated within the previous month were included in the study. Treatment was carried out at the discretion of the therapist. Two groups were divided into group I-physiotherapy and group II-Manual therapy. Manual therapy involved stabilization exercises

and mobilization techniques. Physiotherapy involved TENS, US and a home exercise programme. Group I was taken for 20 sessions and group II for 10 sessions. Pain intensity and cervical movements were evaluated before and after treatment. One session cost was 35 million Turkish Liras for these patients treated with conventional physiotherapy and 19 million Turkish Liras for manual therapy. Outcome measures were primarily changes in pain intensity and general health, both assessed with visual analog scale and Oswestry pain disability questionnaire. Both treatment strategies were efficient in patients with back/neck pain but manual therapy technique was found more effective in decreasing pain and increasing cervical movements and also cost effective because of short treatment period in these patients.

**LUMBAL SPINAL STENOSIS: ASSESSMENT OF OUTCOMES ONE-YEAR  
AFTER OPERATIVE AND CONSERVATIVE TREATMENT:  
A PILOT CLINICAL STUDY**

**Magsoud ELVAZI<sup>(1)(B)</sup>, Gül BALTACI<sup>(1)(O)</sup>, Ali Kemal US<sup>(2)(O)</sup>, Nevin ERGUN<sup>(1)(O)</sup>**

*Institution(s)*

<sup>1)</sup> *School of Physiotherapy and Rehabilitation; Hacettepe University, 06100, Ankara, Turkey*

<sup>2)</sup> *Orthopaedic Surgery Department; Ankara University İbni Sina Hospital, 06100, Ankara, Turkey*

The present study focuses on the one-year prognosis of radiographically verified stenosis of the lower lumbar spine. The purpose was to describe the outcomes from Roland-Morris, Oswestry, SF-36 Quality of Life Scales and Lumbar Examination Form after diagnosis of spinal stenosis and to identify factors predicting disability after operative (n=6) or conservative (n=7) treatment. Data were compiled on 13 patients (7 women and 6 men) with changes in patients with lumbar spinal stenosis diagnosed by MRI. Their mean age at the interview was 46 years. In the interview, subjective outcome assessment was obtained with a structured questionnaire, and

the low back disorder was scored using the Roland-Morris Scale, Oswestry Disability Index, SF-36 Health Survey. The severity of the stenosis significantly predicted disability, even the effects of age, sex, therapy regimen, treatment sessions and body mass index were adjusted for stenosis type according to operative or conservative. Randomized clinical trials are needed to establish the indications for surgical and conservative treatment. Radiographic severity of lumbar spinal stenosis should be considered as an effect-modifying or confounding factor in clinical trials and other studies focusing on the outcome of lumbar spinal stenosis.



## **EFFECTIVENESS OF MANIPULATIVE PHYSIOTHERAPY FOR THE TREATMENT OF WHIPLASH INJURIES**

**Volga Bayrakcı TUNAY<sup>(1)(B)</sup>, Gül BALTACI<sup>(1)(O)</sup>, Nevin ERGUN<sup>(1)(O)</sup>, Ayşenur BESLER<sup>(1)(O)</sup>**

*Institution(s)*

*1) Hacettepe University; School of Physiotherapy and Rehabilitation Sports Physiotherapy Unit  
06100 Ankara Turkey*

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The purpose of this study was to determine the effects of physiotherapy and rehabilitation programme in patients with whiplash injury. Fiftythree patients with chronic symptoms associated with whiplash injury were treated with physiotherapy and rehabilitation programme included TENS, manual therapy techniques, stretching and stabilization exercises. The therapeutic effects were evaluated with pain inten-

sity by the visual analogue scale and muscle testing according to Cyriax. Mean pain intensity was 8/10 and muscle strength was fair before treatment. After treatment pain intensity was 3/10 and muscle strength was good. In chronic whiplash injuries, early physiotherapy and rehabilitation has been shown to reduce pain and increase cervical movements.

## THE PAIN INTENSITY LEVEL AND PHYSICAL FUNCTION IN PATIENTS WITH CERVICAL DISC HERNIATION: EFFECTIVENESS OF MANUAL THERAPY

Volga Bayrakçı TUNAY<sup>(1)(B)</sup>, Gül BALTACI<sup>(1)(O)</sup>, Nevin ERGUN<sup>(1)(O)</sup>, Ümmühan Baş ARSLAN<sup>(1)(O)</sup>

*Institution(s)*

<sup>1)</sup> Hacettepe University; School of Physiotherapy and Rehabilitation Sports Physiotherapy Unit  
06100 Ankara Turkey

The purpose of this study is to determine the effectiveness of manual therapy for patients with cervical disc herniation. Forty-five patients with complaining of neck pain with radiation of pain, tingling into the upper extremities and complaining about problems during daily life activities were included in the study. The patients were prescribed a treatment including mobilization techniques and stabilization exercises. The me-

an of pain intensity was 8/10 before treatment; it was decreased to 3/10 after treatment ( $p<0.05$ ). Patients with cervical disc herniation were responded well to the treatment programme and they were return to their daily living without any complaints; We recommend a multidisciplinary rehabilitation with cognitive behavioral therapy and psychological interventions.