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DEAR COLLEAGUES,

We sincerely wish the new education year of 2016-2017 brings peace, happiness and health to all my colleagues and their families. We are happy to accomplish the fourth issue of 2016.

There are 6 clinical research articles in this issue. The first article is about the morphologic analysis of the angle of lumbar facet joint. In the second article, malposition of the pedicular screws have been evaluated in the scoliosis patients. In the third study, the comparison of two and three vertebral segment in the treatment of isthmic spondylolisthesis has been evaluated. In the fourth study, evaluation of the patients with spinal trauma treated with various methods has done. The fifth article is about the evaluation of the "Turk-omurga"

internet group. The last article is about tuberculosis spondylitis in childhood period. We believe that all those studies will quietly interest the readers.

In this issue, three case report were presented. One of them is about the os odenteidum. Second one is about the case with the osteochondroma due to neural compression. Last one is about pyogenic epidural abscess.

In this issue, a review articles about the orthosis treatment of scoliosis patients was also presented.

In this issue, in the "Frontiers of the Spinal Surgery" section, the biography was presented about the Prof. Necdet ALTUN. The author of this article is Dr. Teoman Benli.

The "Marmara Spinal Group Meetings", which includes İstanbul and neighboring cities and which is conducted to increase the interests of especially assistants and new specialist on spinal surgery and to contribute to their trainings and to transfer the experiences of experienced colleagues and will be organized each month regularly by the regulatory board, and which Assoc. Prof. Dr. Onat ÜZÜMCÜGİL will perform the headship this year just elected and Assoc. Prof. Dr. Halil BURÇ perform the secretariat just elected, you can find the other meeting contents from the announcements section. We wish healthy, successful and peaceful days to Turkish Spinal Surgery family and we present our deepest respects.

Prof. Dr. İ. Teoman BENLİ JTSS Editor

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LUMBAR FACET JOINT ANGLES: A MORPHOMETRIC STUDY

LOMBER FASET EKLEM AÇILARI: MORFOMETRİK ANALİZ

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SUMMARY:

Introduction: Our aim is to make a database of lumbar facet joint angles to understand the mean values and standard deviations so we can predict the values in lumbar facet joint pathologies.

Materials-Methods: We investigated the Magnetic Resonance Imaging (MRI) scans of lumbar spine obtained in adult patients (n=202) who were admitted to our hospital for emergency and outpatient clinics retrospectively. Facet joint angles were measured on axial images of MRI according to Grobler's method.

Results: 202 patients (102 females, 50.49 %, and 100 males, 49.51 %, respectively) were included in the study. Accordingly, mean age of female was $37,03 \pm 11,52$ years and male was $37,55\pm11,53$ years, respectively. None of the variables were found to be significantly different between genders (p>0.05).

Conclusion: We tried to evaluate the mean values of facet joint angles in lumbar vertebras in order to make a database for the comparison studies that investigate the pathologies of facet joints and other spinal diseases.

Key words: Facet joint angle, Lumbar vertebras, Magnetic Resonance Imaging.

Level of evidence: Retrospective clinical study, Level III.

ÖZET:

Giriş: Çalışmadaki amacımız lomber faset eklem açılarından bir veri tabanı oluşturarak ortalama ve standart değerleri anlamak ve bu sayede lomber faset eklem patolojilerindeki değerleri öngörebilmektir.

Materyal-Metot: Acil servise ve polikliniğe başvuran 202 adet erişkin lomber spinal Manyetik Rezonans Görüntüleme (MRI) imajları geriye dönük olarak incelendi. Faset eklem açıları MRI aksiyel görüntüleri kullanılarak Grobler metodu ile ölçüldü.

Bulgular: Çalışmaya 202 hasta (sırasıyla 102 kadın, % 50.49 ve 100 erkek, % 49.51) katıldı. Sırasıyla kadınların ortalama yaşı 37,03 \pm 11,52 ve erkeklerin ortalama yaşı 37,55 \pm 11,53 olarak hesaplandı. Ölçülen değerler açısından cinsiyetler arasında anlamlı bir fark saptanmadı (p>0.05).

Sonuç: Lomber faset eklem açılarının ortalama değerleri ile bir veri tabanı oluşturarak faset eklem ve diğer spinal hastalıklar gibi patoloji çalışmalarında kullanılması hedeflenmiş ve açı değerlerinin Türk toplumunda da literatürle uyumlu olduğu fikri elde edilmiştir.

Anahtar kelimeler: Faset eklem açısı, Lomber vertebralar, Manyetik Rezonans Görüntüleme

Kanıt Düzeyi: Geriye dönük klinik çalışma, Düzey III.

INTRODUCTION:

Facet joint pain constitutes a substantial proportion of spinal pain, which increases in prevalence especially in the elderly. The prevalence of lumbar facet joint pain is 16 % to 41 %. In the cervical spine, the prevalence is 36 % to 67 %, in the thoracic spine the prevalence is 34 % to 48 $\%^{20}$.

The abnormal motion associated with spondylolisthesis, vertical loading from disc degeneration and arthritis can be the cause of facet joint degeneration similar to that seen in other synovial joints^{15,18}. Pain could be the result of an osteophyte impinging on a nerve, a capsule being stretched, synovial villi being trapped within articular surfaces, and chemicals that cause an inflammatory reaction^{13,16}. Facet joints also have been shown to be richly innervated by the medial branches of the dorsal rami^{2,26}. Neuroanatomic and biomechanical studies have shown that facet joints have both free and encapsulated nerve endings; they also have nerves that contain substance P and calcitonin gene-related peptide⁶⁻⁷.

Our aim is to make a database of lumbar facet joint angles to understand the mean values and standard deviations so we can predict the values in lumbar facet pathologies.

MATERIAL AND METHOD:

We inspected the Magnetic Resonance Imaging (MRI) scans of lumbar spine that obtained in adult patients (n: 202) who were admitted to our hospital for emergency and outpatient clinics retrospectively. Inclusion criteria's for patients in the study are; - patients had to be between the ages of 18-60 years old, have undergone a MRI of the lumbar vertebra and had no pathological spinal trauma or spinal disease. Patients were excluded if their radiological examinations were not sufficient for the proposed measurements or if they were known to have pathological conditions of the lumbar spine.

Facet joint angles were measured on axial images of MRI according to Gobbler's method¹⁴. A line was drawn to join two points determined in the most posterior of the vertebral body. Then two anterior and posterior points in the inner surface of the facet joint was determined and the joining line was withdrawn to the former coronal line and the angle was measured (Figure-1)^{14,24}.

Statistical Analyses:

Descriptive data were presented as mean and standard deviations for numerical variables. Independent group comparisons were analyzed with Mann-Whitney U test between genders. A Type I error level of 5 % was considered as statistical significance in analyses. SPSS 18 (IBM Inc., Armonk, USA) was used for the statistical assessments.



Figure-1. L_4 facet joint angle measurement with Grobler's method.

RESULTS:

202 patients (102 females, 50.49 %, and 100 males, 49.51 %, respectively) were included in the study. Accordingly, mean age of female was $37,03 \pm 11,52$ years old and male was $37,55 \pm 11,53$ years old, respectively. The mean facet joint angle values are presented at Table-1. None of the variables were found to be significantly different between genders (p>0.05).

I able-1. Wean values of lumbar facet joint angle							
	Male	Female					
	Mean±SD	Mean±SD	р				
AGE	37,55±11,53	37,03±11,52	0,929				
L1-Right	60,08±9,61	61,3±7,78	0,525				
L1-Left	57,57±8,82	58,44±8,31	0,886				
L2-Right	58,84±10,09	59,3±9,5	0,986				
L2-Left	54,35±7,25	55,54±7,05	0,560				
L3-Right	54,39±7,75	53,26±7,12	0,747				
L3-Left	51,69±9,03	48,2±7,26	0,098				
L4-Right	47,49±11,68	46,66±4,49	0,132				
L4-Left	43,77±10,28	41,14±8,05	0,361				
L5-Right	41,65±12,33	37,29±10,26	0,162				
L5-Left	43,82±9,47	44,62±5,29	0,045				

DISCUSSION:

Facet arthropathy is presented with a progressive pain, rather than an acute process^{3,8}. Patients with facet joint pain are typically older, with patients younger than 50 years being more likely to present with discogenic pain or a centralized pain phenotype⁴. Physical examination finding of facet arthropathy is paraspinal tenderness^{9,10}. Radiological studies proved that disc degeneration precedes the development of degeneration in facet joints with increasing age^{5,12}. Facet arthropathy is commonly observed in advanced imaging studies in all spinal regions, even in asymptomatic volunteers^{22,30}.

The rationale of facet joints as a pain source is established by their abundant innervation^{1,11}. The facet joints could be the cause of spinal axial pain and referred pain in the extremities and chest wall^{21,23}. In the literature, there are many studies show the correlation of facet joint pain with demographic features, pain characteristics, physical findings, and specific signs or symptoms^{11,19}. In addition, referral patterns for joints are variable that facet joint pain can be produced by many other structures in the spine^{19,25,28-29}. Consequently, controlled local anesthetic blocks of spinal facet joints or medial branch blocks are employed to diagnose facet joint pain.

The morphology of facet joint had been discussed in many studies in the literature. In our study, we measured the angles of lumbar vertebra facet joints to understand the mean values. If we know the mean values, it can be useful to understand the pathological values that associated with diseases. Naderi et al. inspected that facet joint angle was increasing with protruded and extruded disc herniations on L₄₋₅ level when they compared with the control group²⁴. Their measurement technique was the same with ours but they measured on computed tomography. Loback et al. studied facet joint angle and disc herniation and they found asymmetric facet joint in central disc herniations and a facet tropism in lateral disc herniations¹⁷. On the other hand Van Schaik et al. studied orientation and shape of facet joint with low back pain but he founded no correlation between side of disc herniation and the facet joint tropism²⁷.

We tried to evaluate the mean values of facet joint angles in lumbar vertebras in order to make a database for the comparison studies that investigate the pathologies of lumbar facet joints and other spinal diseases as well.

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² Department of Orthopaedic Surgery, Gulhane Military Hospital, Ankara, Turkey. COMPARISON OF TWO AND THREE VERTEBRAL SEGMENT POSTEROLATERAL FUSION IN THE TREATMENT OF ISTHMIC SPONDYLOLISTHESIS

İSTMİK SPONDİLOLİSTEZİS TEDAVİSİNDE İKİ İLE ÜÇ MOBİL SEGMENTİN POSTEROLATERAL FÜZYON YAPILMASININ KARŞILAŞTIRILMASI

ABSTRACT:

The aim of this retrospective study was to determine the effect of the number of fusion levels on the clinical results of adult isthmic spondylolisthesis patients who had undergone posterior instrumentation and fusion.

This retrospective study comprised 37 (20 male, 17 female) patients. Radiological evaluation was made by anteroposterior, lateral, oblique and lateral flexion-extension x-rays. The mean age of the patients was $36.4\pm$ 9.2 years and the mean follow-up period was 34.3 months. Three segment fusion was applied to 22 patients and two segment fusion was applied to 15 patients.

In the single-level group screw loosening occurred in 3 patients and screw breakage in 1 due to the pseudoarthrosis. This study has demonstrated that two-level posterior instrumentation and fusion with local bone grafts and demineralized bone matrix have significantly better clinical and radiological results than single-level surgery. To avoid potential complications of posterolateral interbody fusion, two-level posterolateral fusion can be an alternative treatment option.

Key words: Spondylolisthesis; posterior fusion

Level of evidence: Retrospective clinical study, Level III

ÖZET:

Bu retrospektif çalışmanın amacı posterior enstrümantasyon ve füzyon uygulanan erişkin istmik spondilolistesiz hastalarında füzyon uygulanan seviye sayısının klinik sonuçlara etkisini belirlemektir.

Çalışmaya 37 hasta (20 erkek, 17 kadın) dâhil edildi. Radyolojik değerlendirme ön-arka, lateral, oblik ve lateral fleksiyon ekstansiyon grafileri ile yapıldı. Hastaların ortalama yaşı 36,4 \pm 9,2 idi ve ortalama takip süresi 34,3 aydı.

Yirmi iki hastaya üç segment içeren füzyon 15 hastaya iki segment içeren füzyon uygulandı. İki segment füzyon uygulanan grupta 3 hastada implant yetmezliği bir hastada psödoartroz görüldü. Bu çalışma iki seviyeli füzyon uygulananlarda tek seviyeli füzyon uygulananlara göre daha iyi klinik ve radyolojik sonuçlar olduğunu göstermiştir. Posterolateral cisimler arası füzyonun potansiyel komplikasyonlarından kaçınmak için iki seviyeli füzyon uygulanaması önerilir.

Anahtar kelimeler: Spondilolistesiz; posterior füzyon

Kanıt düzeyi: Retrospektif klinik çalışma, Düzey III

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INTRODUCTION:

Lumbar spondylolisthesis is present in about 5% to 6% of the population with various etiopathogenesis. Due to its variant pathological anatomy, the radiological appearance, age and clinical aspect of the patients are different on diagnosis. It generally starts as spondylolysis, a bilateral pars fatigue fracture and becomes spondylolisthesis with a slip of a vertebra over the adjacent one. As the slip increases, disc degeneration and pain starts^{5,7,15}.

Although conservative treatment is the first treatment option, surgery for symptomatic spondylolisthesis in adults has been found to have better clinical results than conservative treatment choices^{13,15}. However, it remains unclear which surgical strategy should be adopted, as there is limited scientific evidence on which to base an optimal treatment method. Discussions on spondylolisthesis treatment have generally focused on reduction, fusion levels, graft choices, and surgical techniques^{6,9,20}.

One of the most preferred surgical treatment options for spondylolisthesis is posterior transpedicular instrumentation of the relevant segments and posterolateral fusion (PLF)^{6,20}. However, it is still a matter of controversy in literature as to how many levels should be fused and instrumented.

The aim of this retrospective study was to determine the effect of the number of fusion levels on the clinical results of adult isthmic spondylolisthesis patients who had undergone posterior instrumentation and PLF.

MATERIALS AND METHODS:

This retrospective study comprised 37 (20 male, 17 female) patients with isthmic spondylolisthesis who had undergone posterior instrumentation and PLF between January 2005 and May 2011. Patients with spondylolisthesis other than Type 2 according to the Wiltse classification were excluded from the study. Pre and post-operative radiological evaluation was made by anteroposterior, lateral, oblique and lateral flexion-extension x-rays. Preoperative spondylolisthesis slippage grading was evaluated according to the Meyerding classification from the preoperative radiographs. The decompression decision was made preoperatively according to magnetic resonance imaging (MRI) and patients' preoperative neurological evaluation. Preoperative and postoperative neurological status, duration of surgery, number of fused and instrumented levels, total blood loss and complications were evaluated from the clinical database. For clinical evaluation of surgical outcomes, the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) applied at the final follow-up were used.

Surgical procedure:

Exposure was obtained from the spinous processes to the transverse processes bilaterally throughout segments planned for fusion. Under fluoroscopic control, 6.5 mm pedicle screws were placed by free-hand technique. No reduction manoeuvre was used. Decompression of the segments, which had been determined by preoperative MRI and clinical examination was performed for the patients with neurological deficit. In all cases PLF was performed. In the area planned for fusion, the spinous processes were resected, peeled off from soft tissues and used for grafting with demineralized bone matrix. Patients were mobilized with a soft brace on the first postoperative day and the brace was continued for 3 months. (Figure-1, 2)

Statistical analysis:

We used the SPSS software package (version 15.0, SPSS, Chicago, IL) and expressed categorical variables as percentages and continuous variables as mean \pm standard deviation (SD) or median (quartiles). Kolmogorov-Smirnov test was used to evaluate whether the distribution of continuous variables was normal. For parameters that showed normal distribution we used the paired sample t test and for parameters that did not show normal distribution the Mann-Whitney U-test was used. Chi-square test was used to analyze categorical variables. Statistical significance was set at p < 0.05.



Figure-1. AP lumbar x-ray of 35 year-old female postop 2 years.



Figure-2. Lateral lumbar x-ray of 35 year-old female postop 2 years.

RESULTS:

All patients had a history of at least 3 months of lumbar pain due to the spondylolisthesis, which had proved to be resistant to conservative treatment. The mean age of the patients was 36.4± 9.2 years and the mean follow-up period was 34.3 months. Low-grade isthmic spondylolisthesis was present at L5-S1 level in 23 patients, at L4-5 level in 13 patients and at L3-4 level in 1 patient. Two-level fusion was applied to 22 patients and single-level fusion was applied to 15 patients. Decompression was performed on 7 patients in the two-level fusion group and on 6 patients in the single-level fusion group. There were no neurological complications after surgery in either group. Mean duration of surgery for single-level and two-level surgery was 160 minutes and 190 minutes (160-240), and average blood loss was 285 ml and 390 ml respectively. There were no differences between the two groups in terms of demographic properties (Table-1).

Table-1. Paramaters of groups during surgery.						
Surgery Time Blood Loss p (min) (ml)						
Single-level	160±29	285±89	0,127			
Two-level	190±34	390±95	0,084			

One of the patients in the two-level PLF group had superficial infection and was treated with debridement and antibiotheraphy. No union complications were seen in the two-level PLF group but in the single-level PLF group, screw loosening occurred in 3 patients and screw breakage in 1 due to the pseudoarthrosis. These four patients were revised with two-level PLF. (Figure-3)



Figure-3. Loosening of screw in single-level PLF.

ODI scores from the final follow-up were 12.2 ± 6.2 in the single-level PLF group, and 9.2 ± 6.4 in the two-level PLF group (p=0,035). VAS scores were 3.2 ± 1.7 in the single-level PLF group and 2.9 ± 1.6 in the two-level PLF group (p=0.043). The ODI and VAS scores of the patients revised with two-level PLF were excluded from the clinical evaluation.

DISCUSSION:

Lumbar spondylolisthesis has several etiopathogenesis factors as was shown by Marchetti and Bartolozzi giving rise to variations in pathological anatomy, radiological findings, age and clinical symptoms of the patients on diagnosis. When conservative treatment options fail, surgery becomes

the next step. Although there have been a large number of studies on spondylolisthesis, there is no clear evidence for a single superior treatment option. Anterior lumbar interbody fusion (ALIF), posterior lumbar interbody fusion (PLIF) and PLF with/without instrumentation are the most widely accepted surgical methods. Whilst PLF with instrumentation is the most preferred treatment for most authors, there is no scientific evidence showing that PLF is disadvantageous compared to PLIF or circumferential fusion^{1,4,8,11} even though the major theoretical advantage of PLIF and circumferential fusion seems to have resulted in improved outcomes compared with PLF. Ekman et al³ found that the type of fusion, whether PLIF or PLF, did not affect the outcome of surgical treatment of adult isthmic spondylolisthesis over a two year follow-up period. Furthermore, PLIF is a more invasive, technically more difficult method requiring a longer operative time, which may result in increased blood loss and higher complication rates^{3,12}. Similarly, Kim et al. could not demonstrate any difference between ALIF and PLF with instrumentation¹¹. Although circumferential fusion was reported as significantly better than PLF at 6 months and 1 year in a study by Swan, no difference was determined at two years¹⁹. In a systematic review of 29 high quality studies, Jacobs and al. found no difference between different fusion techniques¹⁰. In the current study the treatment choice was PLF with instrumentation which is a relatively easy method with a shorter operating time and lower blood loss compared to other techniques in literature.

When performing PLF, slip reduction can be achieved during the same procedure. The advantages of slip reduction include improved spine biomechanics, better nerve root decompression and a better opportunity for fusion by relieving tension and shear forces⁶. Although the major disadvantage of slip reduction is increased risk of neurological injury, there have been numerous studies evaluating slip reduction for adult low grade spondylolisthesis¹⁶⁻¹⁸. In the current study, slip reduction was not performed to avoid the possibility of potential neurological damage and as all the cases had low grade isthmic spondylolisthesis.

To protect one more mobile segment, some authors have preferred single-level postero-lateral instrumentation and fusion instead of two-level^{9-10,12}. However, there is no scientific proof to help determine the number of fusion levels and this decision is based on the surgeon's empirical experience. In a prospective study by Inage et al, two-level fusion with local bone grafts was shown to cause increased pseudoarthrosis⁹. Similarly in a study by Deguchi et al, single-level fusions showed an 82 % fusion rate, and two-level fusions, a 74 % rate radiologically². Higher fusion rates in the two-level fusion group were achieved with rigid spinal implants. The clinical success of that study correlated with the radiological fusion rates. Contrary to the information in literature, local bone grafts mixed with demineralized bone matrix (DBM) were used in the current study to achieve union for both groups and no union problem was seen in the two-level fusion group. Pseudoarthrosis was observed in four cases in the one -level fusion group.

Although some authors have reported incongruity between the clinical results of spondylolisthesis patients and union rates, VAS and ODI are the most reliable clinical tests to evaluate spondylolythesis^{4,8,14}. The results of the current study reveal that two-level posterior instrumentation with PLF has better results than single-level surgery according to VAS and ODI.

This study has some limitations. Firstly, the retrospective design did not allow for uniformity of the groups. The number of patients was also limited to achieve generalized results. Although the pedicle screws were all 6.5 mm in size, they were not all from the same manufacturer, so implant problems were disregarded.

CONCLUSION:

In conclusion, this study has demonstrated that two-level posterior instrumentation and PLF with local bone grafts and DBM have significantly better clinical and radiological results than single-level surgery. To avoid potential complications of PLIF, two-level PLF can be an alternative treatment option.

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EVALUATION OF SCREW MALPOSITION BY RADIOGRAPHY IN LENKE TYPE 1 ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS HAVING UNDERGONE SELECTIVE FUSION

SELEKTİF FÜZYON YAPILAN LENKE TİP 1 ADÖLESAN İDİYOPATİK SKOLYOZLU HASTALARDA VİDA MALPOZİSYONUNUN DİREK RADYOGRAFİ İLE DEĞERLENDİRİLMESİ

ABSTRACT:

Aim: In recent times, instrumentation with pedicle screw is a widely used method in vertebral surgery. In this study, we aimed to evaluate rate of the most common complication of this method, namely, pedicle screw malposition and its clinical implications in patients diagnosed as Lenke Type 1 idiopathic scoliosis and thus having undergone posterior intervention and instrumentation.

Patients and Method: Forty-nine patients have undergone posterior intervention and instrumentation because of Lenke Type 1 adolescent idiopathic scoliosis between 2005 and 2011 and 42 of them with continuous screw placement was included into the study (6 males; 36 females; mean age 13.8 years). Position of screws placed into thoracic and lumber pedicles was evaluated by anteroposterior and lateral post-op radiographies by three orthopaedists.

Results: A total of 944 pedicle screws were found to be placed into thoracic and lumbar pedicles. Mean number of placed screws per patient was calculated as 22.5. Most of the screws were placed at T3-T4-T5-T6-T7-T8-T9-T10-T11-T12 (n:84) vertebra segments and L2 (n:2) segment was the level where the lowest number of screws were placed. Rate of screws in normal position within the pedicles was 86.4% (n=816) and the rate of screws out of the pedicles was 13,6% (n=128). 74(57.8%) of the screw malposition were at lateral of the pedicle and 35 (27.3%) were at the inferior of the pedicles, 13 (10.2%) were at the superior of pedicle or at upper disc distance, 6 (4.7%) were at medial of the pedicle and 63% of these screws were at concave side and 37% were at convex side. Screw malposition was most commonly observed at T11 level. There was no screw malposition at L1-L2 levels. No complication with early symptoms was observed in any of the patients.

Conclusion: In this study; although rate of screw malposition was 13,6%, absence of any complication such as neurological deficit, pseudo-arthrosis, infection and pulmonary emboli at early stage has revealed that instrumentation by placing pedicle screws free hand in surgical treatment of adolescent idiopathic scoliosis is a safe and appropriate surgical method.

Key words: Adolescent idiopathic scoliosis, Lenke type 1 curve, posterior selective fusion, screw malposition

Level of evidence: Retrospective clinical study, Level III

ÖZET:

Amaç: Bu çalışmada vertebra cerrahilerinde yaygın bir şekilde kullanılmaya başlanan pedikül vidası ile enstrümantasyonun en sık komplikasyonu olan pedikül vida malpozisyonu oranlarını ve kliniğe yansımalarını Lenke tip 1 idiopatik skolyoz tanısıyla posterior girişim ve enstrumantasyon uygulanan hastalarda değerlendirmeyi amaçladık.

Hastalar ve yöntem: Çalışmaya 2005-2011 yılları arasında Lenke tip 1 adölasan idiyopatik skolyoz tanısı ile posterior girişim ve enstrumantasyon uygulanan 49 hastanın boşluk bırakılmadan vida yerleştirilen 42'si çalışmaya dahil edildi (6 erkek; 36 kadın; ortalama yaş 13.8). Torakal ve lomber pediküllere yerleştirilen vidaların pozisyonları ameliyat sonrası çekilen ön-arka ve yan direk radyografiler ile üç ortopedist tarafından birlikte değerlendirildi.

Sonuçlar: Toplam 944 pedikül vidası torakal ve lomber pediküllere yerleştirildiği saptandı. Hasta başına yerleştirilen vida sayısı ortalama 22.5 olarak hesaplandı. En çok vida yerleştirilen seviyeler T3-T4-T5-T6-T7-T8-T9-T10-T11-T12 (n:84) vertebra segmentleri olurken, en az vida L2 (n:2) seviyesinde kulanıldı. Pedikül içinde normal yerleşim gösteren vidaların oranı %86.4 (n=816) iken pedikül dışında olanların oranı 13,6% (n=128) olarak saptandı. Hatalı vidaların 74'ü (%57.8) pedikül lateralinde, 35'inin (%27.3) pedikül inferiorunda, 13'ünün (%10.2) pedikül süperiorunda veya üst disk mesafesinde, 6'sının (%4.7) ise pedikül medialinde olduğu görülürken bu vidaların % 63'ü konkav, %37'sinin konveks yüzdeydi. Vida malpozisyonu en çok T11 seviyesinde görüldü. L1-L2 seviyelerinde malpozisyon saptanmadı. Hiçbir hastada erken dönemde klinik semptom veren bir komplikasyon saptanmadı.

Tartışma: Bu çalışma; %13,6 oranında vida malpozisyon görülmesine rağmen erken dönemde herhangi bir nörovasküler defisitin saptanmaması, psödoartroz, enfeksiyon, pulmoner emboli gibi komplikasyonların görülmemesi adölesan idiyopatik skolyoz cerrahi tedavisinde serbest uygulanan pedikül vidaları ile enstrumantasyonun güvenilir ve uygun bir cerrahi teknik olduğunu göstermektedir.

Anahtar kelimeler: Adölesan idiyopatik skolyoz, Lenke tip 1 eğrilik, posterior selektif füzyon, vida malpozisyonu

Kanıt düzeyi: Geriye dönük klinik çalışma, Düzey III

INTRODUCTION:

In spinal surgery, fusion instrumentation by using pedicle screws is widely used for correcting deformities such as traumatic, infective, degenerative and tumour deformities or deformities due to scoliosis. Biomechanically, pedicle screw is superior to sublaminar wires, hooks and laminar screws. Moreover, spinal segments may easily be controlled by pedicle screws and smaller number of vertebral segment fusion is adequate for stability. Thus, fusion instrumentation by using pedicle screw is frequently preferred⁴.

Scoliosis is a complex curvature of the spine occurring as a result of rotating of the spine around its own axis and leads to postural distortion not only at coronal plane but all of the three planes. The most common deformity of the spine is scoliosis and surgically most treated type of the scoliosis is Lenke type 1 adolescent idiopathic scoliosis. The most frequently encountered form of scoliosis is Lenke type 1 adolescent idiopathic scoliosis and those are the most treated patients^{2.5}.

To prevent heterogeneity in the study we evaluated pedicle screw malposition of patients having undergone posterior intervention and instrumentation because of Lenke type 1 idiopathic scoliosis between 2005-2011.

PATIENTS AND METHOD:

Forty-nine patients have undergone posterior intervention and instrumentation because of Lenke Type 1 adolescent idiopathic scoliosis between 2005 and 2011 and 42 of them with continuous screw placement was included into the study. Patients in whom bilateral pedicle screw was placed at all levels were evaluated. Seven patients were excluded because one or several screws were skipped. 6 of the patients were male and 36 of them were females; mean age of the patients was 13.8 years.

At the pre-op period anteroposterior, lateral and right and left bending radiographies of all patients were taken. Pedicle screws were placed in all of the subjects by using free-hand technique. Screws were placed in the cranio-caudal direction along the anatomic axis of the pedicle. C-arm radioscopy was used to check the rods before placement. In our subjects, usually polyaxial pedicle screws with a diameter of 4.0 -4.5 mm were preferred for T1-T6 vertebrae, 5.5 mm for T7-T12 and 6.5 mm for L1-L2.

Pedicle screw position was evaluated by three orthopaedics specialists via anteroposterior and lateral plain radiographies taken post-operatively. Five criteria were used by three orthopaedics specialists during the evaluation of screw position via antero-posterior and lateral direct radiographies taken post-operatively:

1. In the anteroposterior radiography pedicle screw should be within the elliptic pedicle image.

2. Tip of the pedicle screws shouldn't exceed midpoint of the vertebral body in the anteroposterior radiography.

3. In the anteroposterior plain radiography tip of the pedicle screws should stay within the rectangle forming vertebral body and shouldn't deviate abnormally in the caudal and cranial direction.

4. In the lateral radiography screws should stay within the borders of rectangle forming vertebral body and tip of the screws shouldn't exceed anterior or posterior cortex of vertebral body.

5. In the lateral radiography screws should be within the pedicle and shouldn't reach to superior or inferior of vertebral foramina.

RESULTS

A total of 944 pedicle screws were found to be placed into thoracic and lumbar pedicles. Mean number of placed screws per patient was calculated as 22.5. Most of the screws were placed at T3-T4-T5-T6-T7-T8-T9-T10-T11-T12 (n:84) vertebra segments and L2 (n:2) segment was the level where the lowest number of screws were placed. Diameter of 368 (39 %) screws was 4.0 or 4.5 mm, diameter of 504 (53.4 %) screws was 5mm and diameter of 72 (7.6 %) screws was 6.5mm. Segmental distribution of placed pedicle screws is shown in Table-1.

Rate of screws in normal position within the pedicles was 86.4 % (n=816). Plain anteroposterior and lateral radiographies have revealed that 128 (% 13,6) of the pedicle screws were out of the pedicles. 74 (57.8 %) of the screw malposition were at lateral of the pedicle and 35 (27.3 %) were at the inferior of the pedicles, 13 (10.2 %) were at the superior of pedicle or at upper disc space, 6 (4.7 %) were exceeding medial wall of the pedicle. 63 % of malpositioned screws were at concave side and 37% were at convex side. Screw malposition was most commonly observed at T-11 level. There was no screw malposition at L1-L2 levels (Figure-1).

There was no neurovascular complication associated with pedicle screw malposition. There was no pleural injury, pneumothorax, pleural effusion, dural tear or CSF leakage due to screw placement during surgery. Coronal balance disturbance was detected in one study patient but since the patient wasn't complaining from the condition no surgical intervention was carried out. Likewise, in another patient shoulder asymmetry which doesn't disturb the patient was only clinically monitored. Both of these patients were surgically treated by advancing fusion up to L4 level which was previously left at distal T12 level. Superficial wound infection observed in one patient was treated by parenteral antibiotics. There was no death or complications such as deep vertebral infection and deep venous thrombus.

Table-1. Vertebral segment level of placed pedicle screws and i	naccurate screws and their distribution according to side of the
deformity	

Vertebral	All so	crews	Inaccurat	te screws	Side of misplaced screw areas		
level	No.	percentage	No.	percentage	concave	convex	
T2	32	3.4	1	0.8	1	0	
T3	84	8.9	5	3.9	5	0	
T4	84	8.9	2	1.6	1	1	
T5	84	8.9	5	3.9	2	3	
T6	84	8.9	9	7.0	1	8	
T7	84	8.9	13	10.2	10	3	
T8	84	8.9	16	12.5	12	4	
T 9	84	8.9	13	10.2	6	7	
T10	84	8.9	15	11.8	7	8	
T11	84	8.9	29	22.7	22	9	
T12	84	8.9	20	15.7	14	4	
L1	70	7.4	0	0	0	0	
L2	2	0.2	0	0	0	0	
Total	1 944		128		81	47	



Figure-1. Image of screw malposition in plain posterior radiography.

DISCUSSION:

Scoliosis surgery requires a long learning curve and need for experience; however, despite its catastrophic complications instrumentation with pedicle screws is increasingly becoming popular in surgical treatment of adolescent idiopathic scoliosis. Even though it's a catastrophic and high risk surgery complications are rarely reported. We assume that low complication rate probably occurs because of the reason that scoliosis surgery usually carried out in experienced centres as a team work. In our clinic, pedicle screws are placed by an experienced operating team that has been dealing with scoliosis surgery nearly for 20 years and thus rate of screw malposition is 13.6 % in line with the literature. Despite the current rate of malposition, there was no clinically symptomatic complication at the early stage in any of the patient.

Studies have shown that pedicle screw malposition rate varies between 1.2 % and 40 % in scoliosis surgery and complications due to screw malposition vary between 0 % and 0.9 %^{6,7,9,18}. We assume that the probable reasons for the observed wide range in above mentioned rates are evaluation of patients who are in different scoliosis grades and more importantly employment of different evaluation methods. In our study, screw position was evaluated via anteroposterior and lateral radiographies. In our patients, we didn't use CT in evaluating pedicle screw position and this may be considered as one of the weaknesses of our study. Although plain radiographies have been evaluated stringently through the eyes of three different orthopaedics specialists, the low rate of screw malposition may be due to non-use of CT in routine evaluation. Thus, screw malposition rate was found as 11 % by Hicks et al., in a literature review including 21 studies evaluating screw malposition by plain radiography; however, the rate increased to 15.7 % in the studies employing computerized tomography (CT) in post-op follow up⁷.

Various pedicle screw placement techniques such as several navigation systems, or robot or goniometry use were described because of high malposition risk during screw placement^{2-4,12-14}. However, high learning curve, high cost and long operation time and excessive blood loss have impeded widespread use of these techniques. In addition to pedicle screw malposition, inadequate correction of the curves, intraoperative pedicle fracture, screw loosening and retrieval, dural laceration, infection, pseudo arthrosis, pulmonary, neurological and vascular complications are rarely reported^{1,3,8,11,15-19}.

Free-hand technique described by Kim et al.⁹ is the most commonly used method in pedicle screw insertion to thoracolumbar spine. In their study, although they mentioned from free-hand technique as a safe method, they reported its main disadvantage as its total dependence to experience and competence of the surgeon. Suk et al.¹⁸ have described a novel technique called as "biplanar technique" for insertion of pedicle screw. A kirschner wire is placed into the presumed *pedicle* entry *point* along the appropriate axis and then appropriate entry point and screw axis is determined by taking anteroposterior and lateral plain radiographies. Medial pedicle wall penetration rate was 1.5 % after placement of 4604 thoracic pedicle screw by using this technique.

In Lenke type 1 scoliosis the highest numbers of screws are placed into thoracic spine. Malposition risk is higher during insertion of pedicle screws to thoracic spine compared to lumbar spine; because diameter of spinal canal and pedicle is relatively narrow and there is no anatomic structure indicating entry point unlike lumbar spine²¹. In addition, the pedicles at the concave side in scoliosis patients are thinner, anatomically dysmorphic and sclerotic and all these features increases malposition risk. In our study also rate of malposition was higher in the concave side in accordance with the literature (63 %). Also, since medulla spinalis is more rigid at the concave side, risk of neurological injury due to screw malposition at the concave side is found to be higher compared to the convex side²⁰. Most of the 128 malpositioned screws were observed to be at the lateral of pedicle. T11 level had the highest number of screw malposition and no screw malposition was observed at L1-L2 level.

According to numerous authors, trespassing medial wall by 2 mm of a pedicle screw is considered as in acceptable limits.

Moreover, Kim et al.¹⁰ considered medial wall trespassing by 2 mm-4 mm as safe. Papin et al.¹⁶ have found in a patient that 4 mm excess of 2 screws has led to epigastric pain, resting tremor at right leg and dysesthesia at the leg and the symptoms were relieved after changing the screws. Application side is also important for potential neurological complications in addition to medial wall penetration. We think that particularly in rigid curvatures we should be more careful at concave side while placing screws. We also think that spinal monetarisation during placement of each screw and anteroposterior, lateral and oblique fluoroscopic imaging during operation to confirm accurate screw axis are important in preventing potential neurological complications.

In scoliosis surgery, well apprehension of 3-dimensional anatomic structure of particularly the pedicle and spine and instrumentation with free-hand insertion of pedicle screws following a sound pre-op planning is a safe surgical method that shortens the duration of operation, reduces blood loss and increases stability.

We have found that 128 of the 944 screws placed to 42 adolescent idiopathic scoliosis patients were out of the pedicles. In this study, despite 13.6 % screw malposition, there was no early stage complication such as neurovascular deficit, pseudoarthrosis, infection or pulmonary emboli. However, that doesn't mean instrumentation by pedicle screws via freehand technique is totally safe. Screw malposition should be minimized in order to avoid probable complications of malposition. We think that probable screw loosening and screw retrieval due to malposition should be radiologically and clinically monitored in late stage follow up of these patients.

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TRAUMATIC THORACOLUMBAR FRACTURES: ANALYSIS OF CLINICAL SERIES

TRAVMATİK TORAKOLOMBER KIRIKLAR: KLİNİK SERİLERİN ANALİZİ

SUMMARY:

Introduction: The most common spinal fractures are seen at thoracolumbar region because it is the transition zone between the relatively rigid thoracic and more flexible lumbar spine. Our aim is to analysis our traumatic thoracolumbar fracture cases at this region.

Materials-Methods: Patients who had applied to the emergency clinic for thoracolumbar trauma were investigated. 44 patients who were operated for thoracolumbar trauma were collected for the study. The files and radiological data inspected retrospectively.

Results: The division of patients' histories are 77.30% falling down, 13.60 % traffic accident, 4.50 % gunshot wound and others are rare traumas. The diagnosis rates are 63.70 % compression fractures, 20.50 % burst fractures, 6.80 % burst + compression fractures and the rest is the other kind of fractures. The percentages of spinal region are 15.90 % thoracic, 45.50 % thoracolumbar and 38.60 % lumbar. When you look at the surgery rates, it is 63,70% stabilization and fusion, 31,80 % kyphoplasty and 4,50 laminectomies.

Conclusion: We try to analysis our experience on traumatic thoracolumbar fractures that completed with surgery.

Key words: Thoracolumbar fractures, Trauma, Thoracolumbar fracture management

Level of evidence: Retrospecive clinical study, Level III.

ÖZET:

Giriş: Spinal bölge kırıklarının en sık görüldüğü yer torakolomber bölgedir çünkü rijit torakal ve hareketli lomber bölge arasında geçiş bölgesidir. Amacımız travmatik torakolomber kırık vakalarımızı analiz etmektir.

Materyal-Metot: Acil servis kliniğine torakolomber travma nedeniyle başvuran hastalar araştırıldı. Torakolomber kırık nedeniyle ameliyat edilmiş 44 hasta seçildi. Dosyalar ve radyolojik veriler retrospektif olarak incelendi.

Bulgular: Hastaların başvuru hikayelerinin oranları % 77.30 düşme, % 13.60 trafik kazası, % 4.5 ateşli silah yaralanması ve kalanlar da nadir görülen travmalardan oluşmaktadır. Tanı oranları ise % 63.70 kompresyon kırıkları, % 20.50 patlama kırıkları, % 6.80 patlama + kompresyon kırıkları ve kalanlar ise diğer tip kırıklardır. Spinal kırık bölgeleri % 15.90 torakal, % 45.50 torakolomber ve % 38.60 lomber bölge olarak bulundu. Ameliyat oranları da % 63.70 stabilizasyon ve füzyon, % 31.80 kifoplasti ve % 4.50 laminektomi olarak saptandı.

Sonuç: Bu çalışmada omurga kırığı olan hastaların çoğunluğun yüksekten düşme sonucu yaralandığı, neredeyse yarısının torakolomber bölgeye lokalize olduğu, büyük çoğunluğunun kompresyon kırığı olmasına karşın % 60'ın üstünde opere edildiği saptanmıştır. Bu verilerin literatürle uyumlu olduğu, ancak cerrahi tedavi eğiliminin seride daha yüksek olduğu belirlenmiştir.

Anahtar kelimeler: Torakolomber kırıklar, Travma, Torakolomber kırık yönetimi

Kanıt düzeyi: Retrospektif klinik çalışma, Düzey III

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INTRODUCTION:

By development of technology, high energy injuries are more often and spinal fractures are usually the result of these injuries. For example traffic accidents are seen 40 % to 45 %, 15 % to 30 % voluntary or involuntary falls (include suicides), 15 % to 25 % sport, work, leisure accidents¹³. Studies showed that, 230 of one million person have spinal fractures each year¹⁷. Spinal fractures can also seen attending by 30% cranial trauma, 16 % to 18 % thoracic trauma and 10% abdominal trauma²⁰.

The most common spinal fractures are seen at thoracolumbar region (60 %) because it is the transition zone between the relatively rigid thoracic and more flexible lumbar spine¹². Also there is a major risk of neurologic deficit by this region⁸. Neurologic deficit rate is 15% to 30% in these cases¹.

The management of thoracolumbar fractures is still remaining controversial^{21,25}. However, the main goal is keeping patients alive, protecting from neurologic deficits, stability of spinal column and early mobilization-rehabilitation of the patients¹⁵.

Our aim is to analyze our traumatic thoracolumbar fracture cases by demographic features, history, diagnosis and type of surgery.

MATERIALS AND METHOD:

Patients who had applied to the emergency clinic for thoracolumbar trauma were investigated. 44 patients who were operated for thoracolumbar trauma were collected for the study. The files and radiological data inspected retrospectively.

RESULTS:

We evaluated 11 female (25 %) and 33 male (75 %) patients. Female patients ages were between 15 to 80 and males were 14 to 80.

The division of patients' histories are 77.30 % falling down, 13.60 % traffic accident, 4.50 % gunshot wound and others are rare traumas (Table-1).

The diagnosis rates are 63.70 % compression fractures, 20.50 % burst fractures, 6.80 % burst + compression fractures and the rest is the other kind of fractures as described at Table-1. The percentages of spinal region are 15.90 % thoracic, 45.50 % thoracolumbar and 38.60 % lumbar.

When you look at the surgery rates, it is 63.70 % stabilization and fusion, 31.80 % kyphoplasty and 4.50 % laminectomy. The details of the patients are shown on Table-1 as well.

Table-1. Data of thoracolumbar fracture cases							
AGE	GENDER	HISTORY	DIAGNOSIS	SURGERY			
80	F	Fall	T12 Compression fracture	T12 Kyphoplasty			
63	М	Fall	T12 Compression fracture	T11-L1,2 Stabilization and Fusion			
35	М	Traffic Accident	L1 Compression fracture	T11,12-L2,3 Stabilization and Fusion			
50	Μ	Fall from height	L3 Burst fracture	L2,3,4 Stabilization and Fusion			
19	М	Fall from height	L2 Compression fracture	T12-L1,3 Stabilization and Fusion			
44	М	Fall from height	L1 Compression fracture	T11,12-L1,2 Stabilization and Fusion			
16	М	Fall from height	T12-L1 Burst fracture	T10,11-L2-3 Stabilization and Fusion			
29	F	Fall from height	L2 Burst fracture+T11-12 epidural hematoma	T12-L1,3,4 Stabilization and Fusion			
30	F	Fall from height	L2 Burst fracture	T12-L1,3,4 Stabilization and Fusion			
62	М	Fall from height	T12 Compression fracture	T10,11-L2,3 Stabilization and Fusion			
56	М	Fall from height	L4 Burst fracture	L2,3,5 Stabilization and Fusion			
37	М	Traffic Accident	T8-9 Compression fracture	T6,7,8,9,10 Stabilization and Fusion			
51	М	Fall from height	L1,2 Compression fracture T11,12-L1,2,3 Stabilization and				
41	М	Fall from height	L1 Compression fracture	T11,12-L1,2 Stabilization and Fusion			
19	Μ	Traffic Accident	L4 Compression fracture	L3,4,5 Stabilization and Fusion			
14	М	Fall from height	L4 Compression fracture	L2,3,4,5-S1 Stabilization and Fusion			
30	F	Elevator accident	L1 Burst fracture +L2 compression fracture	T12-L1,2,3,4 Stabilization and Fusion			
29	М	Fall	L1,2+L4 Compression fracture	T12-L1-,2,3,4,5-S1 Stabilization and Fusion			
15	М	Fall	T11-12 Dislocation	T10,11-L1,2 Stabilization and Fusion			
15	М	Fall from height	L1 Burst fracture	T11,12-L2,3 Stabilization and Fusion			
44	М	Fall from height	T2-3 Dislocation	T2,3,4 Stabilization and Fusion			
17	F Fall from height L1 Compression fracture+L2 and L5 Burst fracture T11-S1 Stabilization and Fusion			T11-S1 Stabilization and Fusion			

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AGE	GENDER	HISTORY	DIAGNOSIS	SURGERY
45	М	Gun shot wound	T8,9 pedicle and lamina fracture+T10 spinous process fracture	T8,9 Total laminectomy
19	M	Traffic Accident	T9,10,11,12 Compression fracture	T9,10,11,12 Kyphoplasty
80	M	Fall from height	T12 Compression fracture	T12 Kyphoplasty
17	F	Fall from height	L1,2,3 Compression fracture	T4-L11 Stabilization and Fusion
37	M	Traffic Accident	T12 Compression fracture	T10,11-L1 Stabilization and Fusion
15	M	Fall from height	L2 Burst fracture	T12-L1-L3 Stabilization and Fusion
40	M	Squeeze in machine	T12 Burst fracture	T11-L1 Stabilization and Fusion
35	M	Fall from height	L1 Compression fracture	T11,12-L2,3 Stabilization and Fusion
29	M	Gun shot wound	T7-8 pedicle and lamina fracture	T7-8 Total laminectomy
81	M	Fall from height	L1 Compression fracture	L1 Kyphoplasty
19	М	Fall from height	L2 Burst fracture	T12-L1,2,3 Stabilization and Fusion
47	F	Fall	L3 Compression fracture	L3 Kyphoplasty
15	F	Fall from height	T12-L1 Compression fracture	T12-L1 Kyphoplasty
58	F	Fall	L1 Compression fracture	L1 Kyphoplasty
20	М	Fall from height	L1 Compression fracture, L2 Burst fracture	T12-L1,2,3 Stabilization and Fusion
18	M	Fall from height	T12-L1,2,3 Compression fracture	T12-L1,2,3 Kyphoplasty
28	М	Fall from height	T12 Compression fracture	T12 Kyphoplasty
44	M	Fall from height	T6,11,12 Compression fracture	T6,11,12 Kyphoplasty
78	F	Fall	L1 Compression fracture	L1 Kyphoplasty
42	F	Fall from height	L1,3 Compression fracture	L1,3 Kyphoplasty
30	M	Traffic Accident	T5,6,7 Compression fracture	T5,6,7 Kyphoplasty
50	M	Fall	L1,2 Compression fracture	L1,2 Kyphoplasty

DISCUSSION:

Thoracolumbar fractures are more frequent in man (2/3) than in woman (1/3) and peak between the ages of 20 and 40 years^{5,16,22}. Between 15 % and 30 % of traumatic fractures occur at the thoracolumbar junction $(T_{11}-L_2)$, whereas 9 – 16 % occur in the thoracic spine $(T_1-T_{10})^{6,9}$. Spinal cord injury occurs in approximately 10 – 30 % of traumatic spinal fractures^{7,14}. Gertzbein and Magerl et al.reported 22 % and 35.8 % neurological deficiencies in thoracolumbar spine fractures^{10,18}.

The susceptibility of the thoracolumbar transition is attributed mainly because the transition from a relatively rigid thoracic kyphosis to a more mobile lumbar lordosis occurs at T11-12 level.T11 and T12 thoracic ribs cannot provide enough stability at the thoracolumbar junction, because they do not make a joint with sternum. These ribs are floating free. In the thoracic region, the facet joints are limiting flexion and extension while providing substantial resistance to anteroposterior translation6. The facet joints in the lumbosacral region can increase the degree of potential flexion and extension at the expense of limiting lateral bending and rotation²³. Axial compression, flexion-distraction, hyperextension, rotation, shear forces may act together to produce structural damage to the spine at the time of injury ^{6,23}.

The key point of physical examination of a patient with a spinal injury is on the vital and neurological functions, because

effective resuscitation is critical to the management of spinal cord injury $^{12}\!\!\!$.

There are several classification systems that reported for thoracolumbar injures in the literature². Gomleksiz et al analyzed these classification systems and suggest that three of them are more helpful to evaluate the patient¹¹. These are McCormack's, Vaccaro's and Dennis classifications^{5,19,24}. They also reported that even though there are some objections about Denis classification particularly on burst fractures, classification completes those weak points¹¹.

The management of thoracolumbar fractures is controversial and there is no consensus about treatment. Stability of the vertebral column must be the focus of treatment. There are many treatment options varying from conservative treatment to surgery for thoracolumbar fractures³. The timing of surgery remains controversial. Early decompression(<12hour) resulted in better outcomes compared to both delayed decompression(>24hour) and conservative management in the literature^{12,23,26}. Commonly performed surgical options are stabilization-fusion, vertebroplasty – kyphoplasty, laminectomy, discectomy and minimal invasive techniques like endoscopic and thoracoscopic approaches^{4,22}. In our study we have the ratios of 63,70 % stabilization and fusion, 31,80 % kyphoplasty and 4,50 % laminectomy.

We try to analyze our experience on traumatic thoracolumbar fractures that completed with surgery. About 60 % of thoracic

and lumbar spine fractures are located at the transition $T_{11}-L_1$, 30% in the thoracic spine and 10 % in the lower lumbar spine. A thoracolumbar trauma patient must be evaluated based on up to date classification systems combined all together for ideal decision-making for treatment.

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RETROSPECTIVE ANALYSIS OF THE TREATMENT OF TUBERCULOSIS SPONDYLITIS IN GROWING SPINE

BÜYÜYEN OMURGADA TÜBERKÜLOZ SPONDİLİTİN TEDAVİSİNİNRETROSPEKTİF DEĞERLENDİRİLMESİ

SUMMARY:

Objectives: The aim of this study to evaluate the results of the tuberculosis at growing spine

Material and Method: Eighteen children under 12 years old were evaluated retrospectively in our study. The mean age at the treatment was 8 (3-12) years old. Patients treated with different treatment modalities as conservative (2 pts), anterior approach (5 pts), anterior approach with instrumentation and anterior-posterior combined approach (7 pts). The number of infected vertebra were 3,2 (1-7) at thoracic area. The complaints of the patients were instability (16 pts), pain (18 pts) and paraparesis (2 pts). Patients was diagnosed with culture and histopathological evaluation of biopsy.

Results: The mean follow–up 15 (2-20) years. Patient latest kyphosis angle after prior surgery or conservative follow up was 61° (130-25) (p<0.01). Anterior debridement without instrumentation (84° ± 21°) have significant increase on kyphosis measurement compare with instrumentation (33° ± 6,3°) (p<0,001). Patients treated with only anterior approach without instrumentation or conservative were healed with excessive kyphotic deformity.

Conclusion: Although the main treatment of the tuberculosis is chemotherapy, in growing spine surgical treatment is mandatory to prevent further deformity. Combined surgical treatment is reliable with high success for serious lesion.

Key words: Tuberculosis spondylitis, childhood, treatment, kyphosis, growing spine.

Level of evidence: Retrospective clinical study, Level III.

ÖZET:

Amaç: Bu çalışmanın amacı büyüyen omurgada tüberküloz tutulumu sonrası tedaviye rağmen ortaya çıkan değişiklikleri değerlendirmektir.

Materyal-Metot: Çalışmamızda 12 yaş altı 18 çocuk değerlendirildi. Ortalama tedavi yaşı 12-3) 8) idi. Hastalardan 2'si konservatif, 5'i sadece anterior apse drenajı ve debridman, 4'ü anterior drenaj ve anterior enstrümantasyon ve geri kalan 5'i antero-posterior yaklaşımla tedavi edilmişlerdir. Ortalama tutulan omur sayısı 3,2 (1-7) olduğu belirlenmiştir. Hastaların tamamında ağrı, 2'sinde ise ilaveten parapleji mevcut olduğu saptanmıştır. Kesin tano biopsi sonrası patolojik ve mikrobiyolojik yöntemlerle konulmuştur.

Sonuçlar: Ortalama takip süresi minimum 2 yıl olup en uzun takip 20 yıldır (Ortalama 15 yıl). Hastaların tamamı dâhil edildiğinde ortalama kifoz açısı 61° (25°-130°) olduğu saptanmış, oluşan artışın istatistiki olarak anlamlı olduğu belirlenmiştir (p<0.01). En fazla artış konservatif ve sadece anterior debridman yapılan hastalarda olmuştur (84° ± 21°). Anterior veya Posterior enstrümantasyon anterior debridmana eklenen hastalarda ise istatistiki olarak anlamlı olacak şekilde daha az bir artış olmuştur (33° ± 6,3°) (p<0,001). Sonuç olarak; 12 yaş altı cerrahi yapılan hastaların tamamında istatistiki olarak önemli bir kifotik artış oluştuğu belirlenmiş, ancak enstrümante edilmeyen grupta çok daha yüksek kifoz deformitesi geliştiği saptanmıştır.

Sonuç: Bu verilerin ışığı altında, 12 yaş altı çocuklarda anterior debridman ile cerrahi yapılan hastalarda ciddi kifotik deformitenin oluşumunun kaçınılmaz olduğu, enstrümante edilen hastalarda bu artışın nispeten daha az olduğu fikri elde edilmiştir.

Anahtar Kelimeler: Tüberküloz spondilit, çocukluk çağı, tedavi, kifoz, büyüyen omurga.

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III.

INTRODUCTION:

Spinal tuberculosis, also known as Pott's disease, is frequently encountered extra-pulmonary form of the tuberculosis. Pott's disease has a growing prevalence in the endemic underdeveloped countries and responsible from the 1-2 % of all global tuberculosis cases, 5 % of which involves children^{5,7,12}.

While bone tuberculosis responds well to antibiotherapy, advanced cases may have kyphosis deformity and associated neurological symptoms followed by bone destruction. Although tuberculosis can be treated with chemotherapy, conservative treatment averagely increases in kyphosis of 15 degrees in all patients, and 3 % to 5 % of patients have high risk for further kyphotic deformity greater than 60 degrees^{4-8,16}.

Although, there is no consensus on modalities of the treatment. Debridement and stabilization with anterior or combined anterior-posterior approaches are recommended. Although, high successful treatment outcomes were reported without complication, literature have lack of comparative studies to evaluate better surgical approaches^{1-4,12-13,16}.

In our study, we assessed clinical and radiological outcomes of the treatment in the growing spine of children under 12 years old.

MATERIAL AND METHODS:

Patients with spinal tuberculosis were retrospectively evaluated. The followed-up patients were 25 children under 12 years with spinal tuberculosis. The clinical diagnosis, sedimentation rates (ESR) reactive protein (CRP) and white blood cell (WBC) counts of patients were evaluated. Standard AP and lateral x-ray radiographs and computed tomography (CT) was obtained in order to evaluate the abscess formation. Magnetic Resonance imaging was performed to determine abscess spreading at medullary canal.

Eighteen patients without no deficiency in radiological and clinical findings were included in this study. The mean age 8 (3-12) years old during the treatment. Patients treated with different treatment modalities as conservative approach (2 pts), anterior approach (5 pts), anterior approach with instrumentation and anterior-posterior combined approach (7 pts). The number of infected vertebras were 3,2 (1-7) at thoracic and thoracolumbar area (Table-1). The complaints of the patients were instability (16 pts), pain (18 pts) and paraparesis (2 pts).

Diagnoses of patients were performed with culture and histopathological evaluation of biopsy samples.

Ambulation with a brace was allowed beginning on the fourth or fifth postoperative day (depending on neurologic status).

All patients received three-drug chemotherapy including isoniazid, rifampicin and ethambutol for 2 months. This was followed by two-drug chemotherapy including isoniazid and rifampicin for another ten months.

Long cassette standing X-ray was evaluated to determine improvement of kyphosis. Measurement was performed by one surgeon according to Cobb measurement.

RESULTS:

All patients were followed-up for 15 (2-20) years. All neurological pathologies were recovered after the surgery. Infection was eradicated after one year starting chemotherapy successfully in all patient without recurrence.

We realized that when conservative treatment was failed, patient was operated again with posterior instrumentation and osteotomy for sharp kyphosis. One patient, operated with anterior debridement was re-operated with posterior instrumentation for increasing kyphosis at the two years after initial operation.

Recurrence of kyphosis was seen in another operated with combined approach after removal of pedicle screw for non-fusion surgery and operated again with posterior instrumentation (Figure-1). Severe kyphosis developed in one patient, operated with anterior debridement where the lesion is in thoracolumbar junction (Figure-2).

Patient latest kyphosis angle after prior surgery or conservative follow up was 61 (25-130) degree. Anterior debridement without instrumentation (84+/-21 degree) have significant increase on kyphosis measurement compare with instrumentation (33+/-6,3 degree) (p<0,001).

Thoracic lesion operated with anterior approach with anterior instrumentation have adequate success rate if the lesion is on the thoracic spine above T10 and the number of the infected vertebra was less than 3 and with only one is collapsed. Combined approach has high success rate to restore sagittal alignment (Figure-3,4).

Table-1. Data of the patients.								
Patient	Age (Year)	Follow-up (Year)	Treatment	İnfected area	İnfected Number of vertebra	Results	Second surgery	Latest Kyphosis
N.Ç.	6	20	Anterior	T8-10	3	Kyphosis	None	74
S.A.	12	20	Anterior	T9-11	3	Kyphosis	None	60
B.U.	7	19	Anterior	T6-8	3	Kyphosis	None	60
E.Ç.	6	19	Anterior	T6-9	4	Kyphosis	Posterior	114
Ö.Ç.	7	18	Ant+post	T5-10	5	Kyphosis	None	95
C.Y.	12	18	Anterior+inst.	T8-9	2	Good	None	36
U.B.	12	18	Anterior+inst	T8-9	2	Good	None	30
E.T.	9	17	Anterior	T5-7	3	Kyphosis	None	60
O.I.	10	17	Anterior+inst	T12-l1	3	Good	None	40
G.D.	5	16	Ant+post	T9-12	4	Good	None	35
A.K.	8	14	Anterior+inst	T12-l1	3	Good	None	45
A.D.G.	8	15	Ant+post	T5-6	2	Good	None	32
Y.A.	10	14	Ant+post	T7-9	3	Good	None	30
S.Ö.	4	13	conservative	T3-9	7	Kyphosis	None	110
B.T	3	3	Post+ant	T10-12	3	Good	None	25
S.K.	10	2	conservative	L1-2	2	Kyphosis	posterior	60
F.K.	3	17	Anterior	T10-L1	4	Kyphosis	None	130
A.T.	4	13	Ant+Post	T12-L3	3	Kyphosis	posterior	60



Figure-1. Recurrence of Kyphosis was seen in patient whom operated with combined approach after removal of pedicle screw for non-fusion surgery and operated again with posterior instrumentation.



Figure-2. Severe kyphosis was developed in patient treated with anterior debridement for Pott's disease.



Figure-3. Combined approach in treatment of spine tuberculosis (Anterior debridement and autologous fibulae graft with posterior instrumentation)



Figure-4. Combined approach in treatment of spine tuberculosis (Anterior debridement and titanium cage with posterior instrumentation)

DISCUSSION:

Spine tuberculosis is the most common type of osteoarticular tuberculosis. İt was well known that the antibiotherapy and surgery are the mainstay treatment modalities and cannot be replaced with chemotherapy in management of patients with spinal tuberculosis. The indications for surgery are reported as; neurological deficits, instability, severe, progressive kyphosis and unsuccessful antibiotherapy for adult and pediatric patients with spinal tuberculosis^{1-8,12-13,16}.

Anterior vertebral collapse due to vertebral body involvement by the disease results kyphotic deformity. The expectation for the of development of kyphotic deformity in growing spine is controversial. Rajasekaran reported that there is a decreasing and an increasing angle of the deformity in 44 % and 39 % of the children, respectively. The state of the growing spine responding to the anterior vertebral collapse varies and actually related to the damage of the anterior vertebral growth plate which was known as an intrinsic factor. The other main factor known as an extrinsic factor is mechanical stress. The success of the treatment depends on the eradication of mycobacterium and obtaining natural sagittal alignment without coronal deformity^{5,7-8}.

Deformities may develop in growing spine of children as different than spine of adults after the treatment. Rajasekaran reported that to have an initial kyphotic deformity higher than 30 degrees with multiple vertebrae invasion especially at junctional area of the spine is a risk factors for further kyphotic deformity for younger children under 10 years old. The other radiological criteria are "spine at risk" view reported as the separation of the facet joint, retropulsion, lateral translation and toppling^{5,7-8}.

In the advanced kyphotic deformity cases, instability, abscess formation, spinal cord pressure, delayed cases or doubt in diagnosis, medical treatment should be considered also with surgery as well. At the same time, as kyphotic deformity may cause atrophic and myelomalasia changes in the spinal cord, serious care needs to be taken for the correction of advanced deformity. Not enough information exists regarding how to plan tuberculosis treatment for growing spines.

Moon et al. reported in their retrospective study that deformities were rarely seen after the posterior spinal instrumentation in pediatric patient and recommended to add anterior surgery for patients with significant abscess formation and severe deformities⁴. Upadhyay et al.¹³ indicated that deformities increased for the pediatric group as different from adult group who underwent only to the anterior surgery for the first 6 months after the surgery but deformities were decreased after the 5-years follow-up of this pediatric patients. In the study of Schulitz et al.¹⁰, anterior remodeling ability was lost and an increase in the deformity was observed for patients who underwent anterior surgery after the destruction of anterior growth plate. After the announcement for the usage of pedicle screw is being effective and safe for growing spine by Harms et al.9, successful outcomes were reported after the reconstructions performed with pedicle screw. Huang et al.3, reported that in the cases which underwent anterior debridement and posterior instrumentation with the usage of short level fusion, there was a decrease in kyphosis from 36 degrees to 22 degrees and 4 degrees' correction loss in the follow-up the patients.

Yin et al.¹⁵ compared isolated posterior instrumentation with the combined approaches and decided that both approaches had successful outcomes but concluded that only posterior instrumentation may be useful in patients without severe bone destruction kyphosis because of high morbidity. Wang et al.¹⁴, performed interbody graft with posterior instrumentation and posterior approaches and reported that kyphosis angle was decreased from 29.7° (range 12–42°) to 5.5° (range 2–10°). Hu et al.² performed anterior debridement and posterior instrumentation with a posterior approach with significant decrease in kyphotic angle. The mean preoperative angle of kyphosis was found to be 35.2° ± 6.8° that reduced to 9.7° ± 1.8°) respectively.

In our study, we observed a development of kyphosis deformity in cases which have tuberculosis specifically in thoracolumbar area and underwent conservative therapy or isolated anterior surgery. Sagittal alignment was resulted in cases who underwent fusion with anterior and posterior surgical approaches. Also, isolated posterior instrumentation may be successfully resulted in these cases in order to decrease the morbidity.

Tuberculous spondylitis is a serious disease which is rare but dangerous for pediatric patients as it may cause progressive deformity and neurological problems. Successful outcomes in growing spines with advanced instability may be obtained by a combined approach involving graft and titanium cages for anterior support and posterior pedicle screw rod combination fusion.

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THE CONTENT ANALYSIS OF POSTS IN ELECTRONIC MAILING GROUP CALLED 'TURK-SPINE'

"TURK-OMURGA" ELEKTRONİK YAZIŞMA GRUBUNDAKİ İLETİLERİN İÇERİK ANALİZİ

SUMMARY:

Objective: The purpose of this study is to define the content of e-mail messages from the group of Turk-spine between 2001 and 2015.

Methods: E-mail messages received from Turk- Spine group were analyzed between 2001 and 2015, documented by categorizing to 6 groups.

Conclusion: 4260 messages have been sent to the group. The number of messages sent in 2001 was 70, this number reached to 1179 in 2013. The main issues in received messages were noted as congress, symposium, meeting announcements (31.7%) and greetings, condolences and social messages (25.3%). Cases and scientific discussions constitute 14.5% and 4.4% of messages, respectively.

Inference: This study reveals the importance of communication of surgeons interested in spine by e-mail. Although there is a minority of scientific topics and messages, e-mail group continues to grow day by day and its importance is increasing.

Keywords: Spine surgery, communication group, scientific publication

Level of Evidence: Retrospective study, Level III

ÖZET:

Amaç: Bu çalışmanın amacı, 2001-2015 yılları arasında turk-omurga elektronik posta grubuna gelen iletilerin içeriklerini tanımlamaktır.

Yöntem: 2001-2015 arasında Türk-Omurga mail grubuna gelen iletiler analiz edildi, 6 gruba kategorize edilerek belgelendi.

Sonuç: Gruba toplam 4260 ileti gönderilmiştir.2001 yılında gönderilen ileti sayısı 70 iken, 2013 yılında bu rakam 1179'a ulaşmıştır. Gelen iletilerdeki ana konular kongre, sempozyum, toplantı duyuruları (% 31,7) ve tebrik, taziye, sosyal mesajlar (% 25,3) olarak kaydedilmiştir. Vaka ve bilimsel tartışmalar ise sırasıyla iletilerin % 14,5 ve % 4,4 'ünü oluşturmaktadır.

Çıkarım: Çalışma, elektronik posta grubunun, omurgayla ilgilenen cerrahların iletişimindeki önemini ortaya koymaktadır. Bilimsel konu içerikli iletilerin azınlık oluşturmasına rağmen, elektronik posta grubu her geçen gün gelişmeye devam ettiği ve öneminin arttığı görüldü.

Anahtar Kelimeler: Omurga cerrahisi, yazışma grupları, bilimsel yayın

Kanıt Düzeyi: Retrospektif çalışma, Düzey III

INTRODUCTION

Data communication has a very important role in the development of medicine undoubtedly. Despite conferences, courses and special publications undertake this task for data communication, e-mail groups provide this task to achieve much cheaper and quicker in academic environment. Electronic mailing lists are discussion groups that members exchange opinions mostly on one topic via e-mail^{4,6,9}. Along with the rapid evolution and the spread of social media, the popularity of e-mail groups is inevitable. Health-related topics researched on the Internet constitute 4% of all the issues in the whole world¹. Turk- spine mail group, founded in 2001, is a mail-group that orthopedics, traumatologists, neurosurgery specialists dealing with spine surgery communicate to each other and speak Turkish⁵. The determination of how the group is used will help us about how effective we use in the future. In this study, numerically and contextually comparison was aimed to describe for e-mails received from Turk-spine group between 2001 and 2015.

METHODS

All messages received from Turk-spine group were evaluated between 2001 and 2015. 4260 received messages were divided into 6 categories. Categories were divided as i) announcements, ii) case discussions, iii) academic discussions, iv) professional discussions, v) social messages, greetings and condolences. Classes that are not categorized into above parts were evaluated as vi) other and unclassified messages. The categorization of messages was done by two distinct orthopedists and checked. The number messages sent, the number of new members joined each year and the total number of members were reached on the page of 'turk-spine' mail group.

Variables varying over time were given as a percentage. Classified variables were presented as graphs. Statistical analysis was not included in this study.

RESULTS

Group founded in May 2001 has 47 members by the end of 2001 while the number of members was 344 by the end of 2015. While the average annual number of new members is 28.6, the most increased number of new participants was 115 in 2013 (Figure 1). Total number of messages sent to group was 4260; the annual average of messages was 284. While the average daily number of messages was 0.3 in 2001, this ratio was 1.3 in 2015. The most frequent sent messages in 2013 increase the level of 3.23 messages / day (Figure-2). While the average daily number of messages was 0.3 in 2001, this ratio was 1.3 in 2015. The most frequent sent messages in 2013 increase the level of 3.23 messages / day (Figure-2). While the announcements constitute the largest portion of messages (1351-31.7%), academic discussions and case discussions were 795 - 18.9% (Table-1).




Table-1. The number of messages by category, 2001-2015 (n=4260).			
Categories	n	%	
Announcements	1351	31.7	
Case Discussions	618	14,5	
Academic Discussions	177	4,4	
> Occupational Discussions	396	9,2	
Social Messages, greetings and condolences	1080	25,3	
Other and unclassified ones	638	14,9	
> Total	4260	100	

DISCUSSION

As well as Internet and social media is the most common communication tool in the last three decades, they come to forefront by using for the purpose of access to information and acquiring the knowledge of professionals in the business. Personal blog pages took the place of sites that healthcare professional used to get true and accurate information especially at the beginning of 19903. In addition to healthcare professionals, patients and their relatives benefited from various websites to get the proper health knowledge^{2.7}. Then, LinkedIn, MySpace, Facebook, YouTube and Twitter follow, and these formations accelerate the evolution of social media by reaching out to a large audience^{3,11}. E-mail groups also accelerated to reach information in parallel with this evolution, contributed to create an environment for experts to share and discuss among each other. In 2001, Orthopedics and Traumatology specialists, who speak Turkish and interested in spine diseases, founded e-mail group called 'Turk-spine group' in order to communicate between brain and neurosurgeons, create a discussion environment.

In this study, we aimed to evaluate the activity of 'Turkspine group' during 15 years. Study showed that the number of posts compared to previous years increased significantly. Undoubtedly, the annual increase in the number of members has a major role for the increase in the annual rate of messages between the years 2001-2015. The total number of members has been 343 by year 2015. Although the average annual number of new members is 22.8, the maximum number of new members for a year is 115 in 2013. Besides the increase in the number of members, increased activities based on spine related conventions, conferences etc. will also explain the increase in the number of posts over the years. The average of 0.77 messages sent per day during 15 years. This rate has reached its highest value in 2013 (3.23 messages/ day). The number or annual messages under 200 during 9 year, rise over 400 for the last 3 years.

When the largest part of messages, which is composed of announcements (31.7%) and social messages (25.3%), are considered, it is understood that the mail group also used as a serious social network. So that members used this e- mail group to share their joys, sorrows and state their condolences and congratulations. Besides, an interesting finding in this study is that discussion of cases (14.5%) and academic discussions (4.4%) were significantly lower. In the study made by McLauchlan and colleagues in 1999, 50% of messages sent during 4 months in e-mail group are related with case discussions and general orthopedics and traumatology¹¹. Morgen and his colleagues examined that 54% of messages sent to the "Norway occupational health' group were found to be related with directly occupational diseases between the years of 1997-200610. In the detailed analysis of the messages, which is conducted by Kose and colleagues in 'Turk-Orthopod' group, 10.8% of messages were related with academic discussions and case discussions. The data found in our study is closer to the results of study conducted by Kose and colleagues and academic discussions were found to be lower than that of other studies.

We thought that the reason of low rate of academic discussions and case discussions resulted from lack of habit of asking questions rather than the quality of the content of the questions. We believe that experienced physicians should encourage less experienced physicians in order to increase academic discussions. While experienced physicians offer their experience, they can provide younger colleagues to participate more to the discussions.

In our study, there are limited features. Messages were classified by 2 orthopedists. As this classification may be affected in terms of the subjective point of view, we tried to solve this by evaluating all messages separately. We did not make a detailed analysis of the content of the messages and demonstrated more quantitative values. There is a need for different investigations about whether it is useful or not by making more detailed analysis in content.

'Turk-spine group' is an active group, which is used by Turkish speaking physicians interested in spine for 15 years. It is a social media community where scientific discussions made; congress, courses and workshops announced; greetings and condolences sent by members each other. In order to increase the rate of scientific discussions, members must be sensitive about unnecessary messages.

With the evaluation of social media and emergence of sites like VuMedi, which have more satisfying video scientifically, and effective forms of expression with slides, mail groups could lose its importance⁸. In the future, it is difficult to predict which social media elements will remain dominant and strong. This success depends on factors such as good design and rich content³. So maybe we can make the group more permanent.

As a result, although scientific topics and messages have a minority in 'Turk-spine' mail group, it was observed that e-mail group has continued to improve with each day and increased its importance.

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OS ODONTOIDEUM: A RARE CONGENITAL ANOMALY

OS ODONTOİDEUM: NADİR BİR KONJENİTAL ANOMALİ

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SUMMARY:

Os odonteideum is a seperate odontoid process from the body of the axis. It is the most common anomaly of the odontoid process. The etiology of os odontoideum remains controversial, although there is emerging consensus on both traumatic etiology and a congenital source. Patients with this condition can be asymptomatic or present with a wide range of neurological dysfunctions. It may cause cervical instability, atlantoaxial dislocation and myelopathy. This anomaly can mimic Type-I and II odontoid fractures. Accurate diagnosis is mandatory to prevent treatment failures. There is a role for conservative treatment of an asymptomatic incidentally found, radiologically stable, and non-compressive os odontoideum. However, surgical treatment has a definitive role in symptomatic cases.

In this study, the case is presented of a 31 year- old male patient with neck pain who was diagnosed with incidental os odontoideum. The diagnosis of acute odontoid fracture was discarded in this case as the radiological findings were of a characteristic cortex with smooth contours, and there was no history of recent trauma, sclerosis or hypertrophy of the anterior tubercle of the atlas.

Keywords: Os odontoideum, congenital anomaly, cervical instability

Level of evidence: Case report, Level IV.

ÖZET:

Os odonteideum odontoid proçesin aksisin gövdesinden ayrı bir kemik parça olmasıdır. Odontoid proçesin en sık rastlanan anomalisidir. Os odontoideum etiyolojisi tartışmalıdır. Travmatik ve konjenital etiyolojisi arasında konsensus hâlâ sağlanamamıştır. Os odontoideum hastaları asemptomatik, semptomatik ya da çok çeşitli semptomla başvurabilirler. Servikal instabilite, atlantoaksiyel dislokasyon ve myelopatiye neden olabilir. Bu anomali Tip-1 ve 2 odontoid fraktürleri taklit edebilir. Doğru olarak tanımlanması olası tedavi yanlışlıklarını önlemek için önemlidir. Asemptomatik olanlar radyolojik istikrarlı ve nöral basısı olmayan os odontoideum olguları konservatif tedavi ile tedavi edilirken, nöral bası ya da semptomatik olanlar carrahi tedavisinin yapılması gerekir. Bu çalışmada boyun ağrısı şikayeti ile başvuran ve ossikulun karakteristik düzgün konturlu korteksinin bulunması, yakın zamanda geçirilmiş travma öyküsünün olmaması, atlasın anterior tuberkülünün skleroz ve hipertrofisi nedeniyle akut odontoid proses fraktürü dışlanarak os odontoideum tanısı konulan 31 yaşındaki erkek hastamızı sunduk.

Anahtar kelimeler: Os odontoideum, ayırıcı tanı, boyun ağrısı, servikal instabilite

Kanıt düzeyi: Olgu sunumu, Düzey IV.

INTRODUCTION:

Congenital anomalies related to the odontoid process have been defined in literature as aplasia, hypoplasia, duplication, condylus tertius, os terminale (os avis) and os odontoideum. Of these, the most frequently seen is os odontoideum⁶. The os odontoideum is an oval or round piece of bone with regular cortical edges, located behind the atlas anterior arch, and is separate from the hypoplastic odontoid process. It has been reported under various names such as "Cleft Dens Disease", "Incomplete Dens Disease" and "Independent Dens Fragment Disease"⁹. First described in literature by Giacomini in 1866, the etiology of os odontoideum is still controversial². The embryology of the odontoid process is complex and the reasons for the controversy are that there is evidence of both congenital and acquired causes^{2-3,9}.

Os odontoideum may cause various symptoms such as atlantoaxial instability, spinal cord compression, myelopathy, neck pain and respiratory dysfunction². Although narrowed spinal canal seen on radiographs and atlantoaxial instability are debated as factors increasing the severity of clinical symptoms, no clear correlation has been seen between radiological findings and clinical symptoms¹¹.

This anomaly may mimic Type-1 and Type-2 odontoid fractures. Accurate identification is important to prevent the possibility of incorrect treatment. The case is here presented of a patient who presented with complaints of neck pain at an external centre and was diagnosed with an odontoid fracture, was referred to our clinic with the indication for emergency surgery, but as a result of the examination was diagnosed with os odontoideum as an uncommon cause of neck pain.

CASE REPORT:

A 31-year old male presented at an external centre with neck pain and on the magnetic resonance imaging (MRI), there was a very severe neck fracture and so the patient was referred to our clinic with the need for urgent intervention. There was no history of trauma.

The patient reported that he had experienced sporadic neck 76 pain. In the physical examination of the patient, there was nothing remarkable. Cervical MRI and cervical spinal CT were applied. On the cervical MRI, a regular bordered ossicle was observed in the posterior of the atlas anterior arch, separate from the hypoplastic odontoid process. There were no findings of signal change in the spinal cord, oedema in the bone or trauma to the surrounding tissues, no damage to the ligamentous structures or narrowing in the canal (Figure-1).

On examination of the cervical spine CT, a small round odontoid process with regular and uniform cortical borders was observed to have separated from the C2 odontoid process base with a wide radiolucent gap and to be located behind the atlas anterior arch (Figures-2, 3).



Figure-1. Sagittal T2-weighted MRI showing the os odontoideum part separate from the main body and natural spinal cord signal intensity.



Figure-2. Reformatted sagittal CT imaging showing hypoplasia of the odontoid process and dystopic os odontoideum separate from the odontoid process, surrounded by well-bordered cortex.



Figure-3. Reformatted coronal CT imaging showing the os odontoideum part separate from the main body.

The bone was located close to the clivus (dystopic os odontoideum). There were no findings of instability on the MR and CT findings. As there was characteristic regular contoured cortex of the odontoid bone and sclerosis and hypertrophy of the atlas anterior tubercle, acute odontoid process fracture was discounted and the diagnosis was made of os odontoideum. The patient had no neurological deficit and stabilization treatment was applied with an external orthosis and follow-up.

DISCUSSION:

Os odontoideum, which is defined as a separate piece of bone in the posterior of the C1 anterior arch is classified into 2 types of dystrophic or orthopic depending on the anatomic placement of the free, independent fragment. In the dystrophic type, the majority of the free fragment is seen to be attached in the clivus inferior third and in the less commonly seen orthopic type, the free fragment moves as in its normal location^{3,6,8-9}. In literature it has been reported that the dystrophic type is most likely congenital⁸. In the current case, os odontoideum was determined as the dystrophic type.

Os odontoideum must be differentiated from a dens fracture. Hypertrophy and sclerosis of the atlas anterior tubercle are used to differentiate os odontoideum from an acute dens fracture^{2,9,13}. Hypertrophy of the atlas anterior arch and impairment of the line to the spinolaminar complex are radiographic findings but are not specific to os odontoideum^{5,13}. In dens fractures, the corners and cortex are irregular. The difference in os odontoideum is that it is oval or round with regular edges, the cortex is protected and the corners are relatively sclerotic^{2,12}. Specifically, the distance between fracture fragments is narrower and the axis extends within the corpus below the level of the superior facets of the vertebrae. On dynamic radiographs, just as the structure of fracture fragments is destroyed so the compatibility of the ends is demonstrated⁹. In the current case, as there was a regular contoured cortex characteristic of the odontoid process, there was no recent history of trauma and there was sclerosis and hypertrophy in the atlas anterior tubercle, acute odontoid process fracture was discounted and the pateint was diagnosed with os odontoideum.

The etiology of os odontoideum is still a matter of debate. That it is seen together with anomalies such as Down's syndrome, Klippel-Feil syndrome and multiple epiphyseal dysplasia, supports that it is congenital^{2,7,10,13}. In recent studies, it has been suggested that a reliable radiological finding of congenital os odontoideum is the joint finding known as the 'jigsaw sign' between the atlas anterior arch and the odontoid and this supports the view of congenital etiology¹³.

It has been reported that the impairment of dens blood flow associated with the stretching of the alar ligaments which are important in providing atlantoaxial stability, could originate from non-union in the odontoid⁴. It is thought that it may ocur because of odontoid fracture not diagnosed in childhood or a lack of immobilisation or in some cases following bone and ligament damage associated with trauma in early childhood¹. Reasons have been suggested of impaired dens blood flow after trauma and non-union in the odontoid or a pseudo joint. This is said when the odontoid does not show union¹³. Some references in lliterature have reported that the odontoid process has developed normally but could not attach to the C2 corpus because of abnormal movement⁹. The attachment of the odontoid process to the C2 corpus should be completed between the ages of 5-7 years¹³.

Whatever the reason, this situation causes the development of a small hypoplastic odontoid in the upper part of the axis corpus and the development of a separate ossicle with no continuity with the axis corpus in the posterior of the atlas anterior arch. In the current case, as there was no history of trauma in childhood, the os odontoideum was considered to be congenital.

Os odontoideum cases may be asymptomatic or symptomatic. As the spinal canal is relatively wide at the C1-2 level, symptoms are not seen in this area⁵. In some asymptomatic cases, the patient is not treated and continues for years with no new problems observed². In symptomatic cases, neck and shoulder pain is most often seen. Less frequently reported symptoms are headache, torticollis, thinness and weakness. The most

serious complication of C1-C2 instability develops because of spinal cord compression or obstruction of the vertebral artery. In literature, many asymptomatic and symptomatic cases have been reported who have not been treated and have continued for years with no new problems observed during follow up.

Asymptomatic cases that are diagnosed incidentally must be well evaluated and the indication for surgery should not be given immediately⁹. In the current case, as there was no complaint other than pain, there was no history of trauma and no neurological deficit was determined, the patient was given detailed information about his condition, a conservative treatment method was selected and the patient was closely monitored. In patients with imaging abnormalities between C1-C2, although os odontoideum is rare, it should be kept in mind as the most frequently observed anomaly of the odontoid process. Asymptomatic and stable cases must certainly be well evaluated and it should be considered not necessary to give indications for surgery immediately.

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OSTEOCHONDROMA OF LAMINA OF C2. A CASE REPORT WITH A RARE LOCATION

C2 LAMINASININ OSTEOKONDROMU. NADİR LOKALİZASYONLU BİR OLGU SUNUMU.

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SUMMARY:

Osteochondroma is the most frequently encountered benign bone tumor, and often it originates from the metaphyseal region of long bones. Osteochondroma is a pathology which may cause neurologic dysfunction and rare neck pain, it is rarely seen in the spinal colon. However, when it involves the spine inferior cervical region is the most affected region and usually posterior components are affected. In this paper, a case originating from C2 vertebral laminae is presented. In our case, involvement of C2 laminae is a rare condition instead of commonly involved regions. Solitary lesions have 1% and multiple lesions have 5-25% malignant transformation rate. Growth of tumral mass and severe pain are the most important signs of malignant transformation.

A 31-year-old female patient had complaints of neck pain that is resistant to all nonsteroidal anti-inflamatory drugs, and left arm for nearly six months. She has not any neural deficit. In the hospitals she has previously referred, the case was considered as a cervical disc hernia and was medically treated and has been followed up without any further investigation. CT and MRG imaging have led to prediagnosis of osteochondroma and since she has severe pain and there was suspicion for malignant transformation surgical excision was planned and tumor has been removed by a large resection. In pathological examination no malignant cell was found but all of her complaints were dissolved.

In the light of these data, when there is very severe pain close to cranial base, presence of a benign bone lesion located in this area should be considered and further investigations should be carried out.

Key words: Cervical vertebra, osteochondroma, spinal tumor, severe cervical pain **Level of evidence:** Case report, Level IV.

ÖZET:

Osteokondrom uzun kemiklerin metafizlerinden köken alan en sık görülen benign kemik tümörüdür. Omurgada nadir görülür ve nadiren ağrı ve nörolojik bozukluğa yol açar. Ancak omurgada en sık alt servikal bölgeyi ve genellikle arka elemanları tutar. Bu çalışmada C-2 omurganın laminasından köken alan bir olgu sunulmuştur. Bu tutulum diğer sık görüldüğü bölgelere nazaran nadir bir tutulumdur. Soliter tek lezyonlar % 1, çoklu lezyonlar ise % 5-25 oranında malign değişime uğrar. Tümöral kitlenin büyümesi ve ağrılı hale gelmesi malign değişim için önemli işaretlerdir.

31 yaşında bayan hasta 6 aydır süren tüm nonsteroid antienflamatuvar ilaçlara dirençli sol kola yayılan ağrı nedeniyle başvurdu. Nörolojik defisiti yoktu. Servikal herni düşünülerek medikal tedavi uygulanan hastaya herhangi bir tetkik yapılmamıştı. CT ve MR incelemelerde osteokondrom saptanan hastada ciddi ağrı olması nedeniyle malign değişim düşünülerek cerrahi planlandı. Patolojik incelemede tipik histopatolojiye sahip kitlenin osteokondrom olduğu saptandı ve postoperatif hastanın yakınmaları tamamen geçti.

Bu verilerin ışığı altında kafa kaidesine yakın bölgelerde ciddi ağrısı olan hastalarda, osteokondrom gibi benign bir kitlenin basısının ağrıya yol açabileceği düşünülerek mutlaka ileri tetkik yapmanın gerektiği fikri elde edildi.

Anahtar Kelimeler: Servikal omur, osteokondroma, spinal tümöor, ciddi servikal ağrı.

Kanıt Düzeyi: Olgu sunumu, Düzey IV

INTRODUCTION:

10-15 % of all bone tumors and 20-50 % of all benign bone tumors consist from osteochondromas^{6,9,12}. Generally, they are seen in metaphyseal regions of long bones, distal part of femur, proximal part of humerus and tibia; however, they may also become manifest in small bones of hands and feet in 10 %, pelvis in 5 %, scapula in 4 % and vertebrae in 2 % of the cases^{1,17}.

The huge osteochondromas in adults suggest malignant transformation. Solitary lesions have 1% and multiple lesions have 5-25% malign transformation rate^{4,16}. As understood from a literature survey, it generally emerges during the second and third decades of life and it is seen two times more frequently in men when compared with women¹¹. Our case is a cervical vertebral osteochondroma with a rare location and resistant to NSAID.

CASE REPORT:

A 31-year-old female patient had complaints of neck and left arm pain for nearly six months. Despite NSAID use the complaints have gradually increased. Physical and neurologic examination results of the patient who was evaluated in our outpatient clinic were trivial. Cervical plain radiograms and 3-D cervical computed tomography (CT) and magnetic resonance imaging (MRI) were requested. On her cervical MRI, a bone lesion with 13 x 5 mm dimensions which demonstrated exophytic extension from the left lamina of C2 vertebra upwards and depressed left lamina of C1 was observed (**Figure-1**).

The patient underwent C1 and C2 left-sided laminectomy (Figures-2).

Pathology preparation was stained with hematoxylin eosine (Figure-3).

At the first postoperative week, in the control visit of the patient whose pathology report revealed presence of osteochondroma, wound site was clean without any collection and also her complaints have regressed markedly.

DISCUSSION:

Osteochondromas are most frequently seen benign tumors of the skeletal system^{3,13}. Osteochondromas are most often seen during an adolescent age where the growth of the body accelerates. Mostly, they are symptomless¹³. In case there are symptoms, the most frequently encountered symptom is pain. However, it's usually mild and responds to analgesics. Apart from this symptom, impingement on nerve and restriction of ROM of the affected joint have been reported^{3,13}.

Osteochondroma can be seen as a solitary or multiple mass lesions. Since nerve compression, swelling and growth problems can develop in osteochondromas with hereditary characteristics, evaluation of these cases should be performed more carefully^{6,13}. Besides, the risk of malignant transformation in this type of osteochondromas is greater relative to solitary forms¹⁵. Especially in the hereditary form malignant transformation has been reported in 3-5 % of the cases¹⁴.



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Figure-2. Postoperative Cervical CT



Figure-3. Pathology preparation stained with hematoxylin eosine



The sudden and rapid growth of the mass lesion, the persistence of its growth after cessation of the development of the skeletal system and pain indicate risk of malignant transformation. As has been reported, it most frequently transforms into chondrosarcoma and rarely into osteosarcoma between 20 and 40 years of age⁷⁻⁸.

As potentially effective factors on the formation of osteochondromas, iatrogenic damage on growth plaque following surgery or traumatic event and radiation exposure have been reported^{3,13}. In the literature, development of

osteochondroma has been reported in patients who had undergone radiotherapy^{6,9,12}.

Direct plain radiograms have an important place in the diagnosis of osteochondromas. One of the characteristic features of osteochondromas is the continuum between the mass lesion and the medulla of the bone where it originated^{6,12}. Definitive diagnosis is based on histopathological examination. The presence of a bone tissue covered with a hyaline cartilage which is in continuum with the bone where it originated establishes the diagnosis⁶. In the presence of pain, neurovascular compression, skeletal deformities, abnormal

developmental process, the risk of malignant transformation and restriction of articular range of motion, surgical treatment is recommended^{1,3,6,9,11,13,17}. Since direct radiograms can hardly diagnose spinal osteochondromas, in our study CT, MRI were used.

CT is required for more precise evaluation of skeletal structures, while MRI is necessitated for the detection of both extradural intracanalicular components of the tumor and also the severity of compression on the neural tissue^{2,10}. In cases where the cervical spine was involved, following decompression symptomatic improvement is seen, even in cases of inadequate excision, disease recurrence is rarely seen.

A 31-year-old female patient had complaints of neck pain that is resistant to all nonsteroidal anti-inflamatory drugs, and left arm for nearly six months. She has not any neural deficit. In the hospitals she has previously referred, the case was considered as a cervical disc hernia and was medically treated and has been followed up without any further investigation. CT and MRG imaging have led to prediagnosis of osteochondroma and since she has severe pain and there was suspicion for malignant transformation surgical excision was planned and tumor has been removed by a large resection. In pathological examination no malignant cell was found but all of her complaints were dissolved.

In the light of these data, when there is very severe pain close to cranial base, presence of a benign bone lesion located in this area should be considered and further investigations should be carried out.

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EXTENSIVE PRIMARY PYOGENIC EPIDURAL ABSCESS LOCATED IN CERVICOTHORACIC REGION IN A DIABETIC PATIENT

DİABETİK HASTADA PRİMER PYOJENİK SERVİKO-TORAKAL YAYGIN EPİDURAL APSE

SUMMARY:

Spinal epidural abscesses are rare infections. Incidence of epidural abscesses is 0.2-2 /10000. Often they are detected mid-thoracic and lower lumbar area. Risk factors of spinal cord abscess are drug abuse, HIV/AIDS, diabetes, immunosuppression.

A 46-year-old male patient admitted to emergency suddenly developed weakness of his extremities and respiratory distress. The patient was intubated immediately and he was taken to intensive care unit. Cranial and spinal magnetic resonance imaging was showed C1 to T8 epidural abscess. Surgery was performed and anti-biotherapy was given.

We keep our mind that spinal epidural abscess cause such as the severe neurological condition in diabetic patients. We may achieve good outcomes with immediate surgical treatment and appropriate anti-biotherapy.

Key words: Diabetes mellitus, spinal epidural abscess, tetraparesis.

Level of evidence: Case report, Level IV

ÖZET:

Spinal epidural apseler seyrek görülen enfeksiyonlardır. Görülme sıklığı 10 000'de 0.2-1.2'dir. Sıklıkla orta torakal ve alt lomber bölgede tespit edilirler. Spinal epidural abse gelişimi için risk faktörleri madde kullanımı, HIV/AIDS, diabet, immunsupresyondur.

Ani bir şekilde gelişen dört extremitede güç kaybı ve solunumda bozulma şikayeti ile acil servise başvuran 46 yaşında erkek hasta, entübe edilerek yoğun bakım ünitesine alındı. Yapılan kranial ve tüm spinal manyetik rezonans görüntülemede C1'den T8'e uzanan epidural apse tespit edildi. Hasta cerrahi yolla tedavi edildi ve uygun antibiyotik tedavisine başlanıldı.

Diabetik bir hastada bu kadar gürültülü bir tablonun altından yaygın spinal apsenin çıkabileceği unutulmamalıdır. Hızlı cerrahi girişim ve uygun antibioterapi ile yüz güldürücü sonuçlar elde edilebilir.

Anahtar Kelimeler: Diabetes mellitus, spinal epidural apse, tetraparezi.

Kanıt Düzeyi: Olgu sunumu, Düzey IV.

INTRODUCTION:

Spinal epidural abscesses (SEA) are rare infections, the incidence is 0.2-1.2 cases in 10.000 admissions^{5,8}. They affect thoracic region in 50 % of the cases with a male predominance at the age of 30 to-60 years^{5,7-8}. Presenting symptoms are fever, local tenderness and neurological signs secondary to spinal cord compression. There are some risk factors such as IV drug abuse, HIV/AIDS, diabetes and immunosuppression. Diabetes and drug abuse were associated with SEA in 18-54 % and 7-40 % of the cases, respectively^{3,4}. Extensive epidural abscess involving cervical and thoracic region is extremely rare⁷.

Management may be purely medical; however, in some cases surgical decompression is also warranted. High mortality (16 %) and morbidity rates were reported in the literature, particularly in patients with delayed diagnosis or insufficient treatments⁷. Early diagnosis and abrupt treatment was associated with better neurological outcome and assigned among important prognostic factors².

CASE REPORT:

A 46 years old male patient was intubated and admitted to intensive care unit following his presentation to emergency room with an acute weakness in all 4 extremities. His neurological examination revealed a severe tetraparesis; muscle strength in bilateral upper extremities being 1/5, 0/5 in right and 1/5 in left lower extremities. Radiological evaluation with cranial and whole spinal magnetic resonance imaging (MRI) demonstrated an extensive space occupying lesion compressing the spinal cord from C1-to-T8 levels. The lesion was enhancing in ring-like fashion and the presumptive diagnosis was spinal epidural abscess. Moreover, the enhancement was not only restricted to spinal canal, but also there were extension into paravertebral soft tissues (Figure-1).



Figure-1. a-b) This postcontrast sagittal T1-weighted cervico-thoracic MRIs demonstrated a space occupying lesion with a ring-enhancement and spinal cord compression extending from C1 to T8 levels. The lesion was compatible with an abscess.

He was operated and the abscess was drained with multiple fenestrations at C2, T1 and T5 levels in order to prevent iatrogenic spinal instability. Later, the epidural space was irrigated with normal saline solution. The dural compression was relieved on intraoperative inspection, which was also documented by postoperative MRI (Figure-2).

Microbiological evaluation and cultures showed meticilline sensitive Staphylococcus aureus.



Figure-2. Postoperative sagittal T2- weighted MRI showed complete drainage of the abscess and relieved spinal cord compression following surgery

The antibiotherapy, consisting of ampiciline, cephotaxime and gentamycin, was implemented. The patient improved promptly; he was extubated 88 in postoperative second day and his muscle strength recovered to 4/5 and 3/5 in bilateral upper and lower extremities in early period, respectively.

DISCUSSION:

Spinal epidural abscess was first defined by Morgagni in 1761⁸. They may present with pain, fever, local tenderness, paresis and urine-fecal symptoms, however, classical triad (fever, pain and neurological deficits) was observed in 75-89 % of the cases⁸. Heusner et al.⁸ classified SEA into 4 categories based on their clinical presentations; pain, radiculopathy, weakness and paresis. Our patient had suffered from an extensive SEA affecting upper cervical region; therefore the clinical findings such as acute tetraparesis and respiratory depression were much more dramatic than ever defined in the literature.

SEA are commonly located in lower thoracic and upper lumbar region, this predilection was correlated with rich venous plexus in this region. The abscess may be primary or secondary in nature. Primary SEA are due to hematagenous spread from distant infectious foci such as recurring skin infections, parenteral infections and decubitus ulcers. Secondary cases are associated with spinal interventions. The abscess are located in the anterior region in case of spondilodiscitis, however, hematogenous cases are prone to posterior part of the spinal cord^{3,5,7}.

Holocord involvement of spine is extremely rare. In the presented case, SEA was situated posterior to spinal cord and caused severe compression. Neurological findings after SEA were correlated with effects of direct compression, vasculitis, thrombosis and spinal cord ischemia due to inflammation.

There are several risk factors for SEA; IV drug abuse, HIV/AIDS, diabetes and immunosuppression with a male predominance (62.5 % of the cases). Common causative pathogens are staphylococcus aureus (63.6 %), gram (-) microorganism, coagulase (-) staphylococcus species (7.5 %) and streptococcus (6.8 %). Meticilline sensivity was observed in 38.9 % of S. Aureus cases⁸, similar to our case.

Surgical management with decompressive laminectomy for a SEA in thoracic region was first performed by Bart in 1911. In our case, for the sake of spinal stability, multi-level fenestrations were preferred for the abscess drainage. Beside this, surgical timing is important in these patients; literature findings indicated a rather poorer neurological outcomes in patients with delayed surgical decompression beyond 72 hours^{2,5-6,8}. Moreover, delayed treatment was also associated with mortality rates up to 5-10 % ^{1-2,6}. There are some reported prognostic factors correlated with poor outcomes, such as age of the patient, extend of spinal cord compression and duration of symptoms^{1-2,6-7}.

In terms of management strategy, medical treatment was preferred for those cases with mild or no spinal cord compression and without neurological deficits. Literature findings denied any benefit from early surgery over medical treatment. However, these patients should be closely monitored for any deterioration in their neurological status and, in case, promptly directed to surgery in first 24 hours⁴.

Spinal epidural abscess should be considered in patients presenting with acute and progressive neurological deficits, particularly in diabetic patients. High degree of vigilance and awareness is warranted because early surgical decompression and culture-proven antibiotic therapy is associated with promising outcomes.

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BRACING IN ADOLESCENT IDIOPATHIC SCOLIOSIS

ADÖLESAN İDİOPATİK SKOLYOZDA KORSE TEDAVİSİ

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Disagreements still continue among healthcare professionals concerning the effect and longterm problems of bracing, one of the non-operative treatments of scoliosis. The differences in the results of studies on the effect of bracing in the literature, unclear procedures of administration and the quality of such studies weakened the confidence in bracing. Moreover, the difficulty of identifying those who are suitable for bracing, the effects of various bracing concepts and the problems concerning the experience and administration skills of the implementers are also influencing factors in practice. The associations of surgical and conservative treatment groups are trying to construct a common algorithm to eliminate the confusion in this matter.

The common conclusion of the evidence-based, randomized controlled studies on the effect of bracing that have been published in recent years is that bracing is successful in adolescents, preferably Risser 2 and under, who are still in the process of maturation and whose spine has a curvature of 25-45°. They also stress the importance of high level of compliance and full-time use of braces for success. Using braces of a correct biomechanical design until the completion of maturation under the common surveillance of a physician and a technician can prevent curve progression and reduce the rate of surgery in scoliotic individuals.

It should also be taken into consideration that bracing can promise a stable and moving spine with no need for fusion even for some children and that it will contribute to well-being by reducing surgical costs and the rate of morbidity.

Key words: Adolescent idiopathic scoliosis, brace

Level of evidence: Review article, Level V

ÖZET:

Skolyozun nonoperatif tedavilerinden olan korsenin etkisi ve uzun dönemde ortaya çıkan sorunlara ilişkin sağlık profesyonelleri arasındaki fikir ayrılığı halen devam etmektedir. Literatürde korsenin etkisine ilişkin çalışmaların sonuçlarındaki farklılıklar, uygulama prosedürlerinin net olmaması ve araştırmaların kalitesi ise korseye olan inancı olumsuz etkilemiştir. Ayrıca korse için uygun olguların belirlenmesindeki zorluk yanında farklı korse konseptlerinin etkisi, uygulayıcıların deneyim ve uygulama becerisindeki sorunlar da pratikte etkilidir. Cerrahi ve konservatif tedavi gruplarının kuruluşları da bu konudaki karmaşayı ortadan kaldırmak adına ortak bir algoritma oluşturmaya çalışmaktadır.

Son yıllarda yayınlanan korse etkisi ile ilgili kanıt düzeyi yüksek randomize kontrollü çalışmaların ortak çıkarımı korsenin 25-45° eğrilikte, maturitesi devam eden, tercihen Risser 2 ve altındaki adölosanlarda başarılı olduğudur. Başarı için ayrıca kompliansı yüksek adölosanlar ve tam zamanlı korse kullanımının önemi de vurgulanmaktadır.

Doğru biyomekanik tasarımı olan, hekim ve teknikerin birlikte takip ettiği korsenin maturasyon tamamlanmasına dek kullanılması skolyotik bireyde eğrilik progresyonunu engeller ve cerrahi oranı azaltır. Korsenin, bir kısım çocuğa bile stabil ve hareketli, füzyon gerekmeyen bir omurga vadetmesi yanında cerrahi maliyet ve morbidite yönü ile de sağlayacağı katkı da unutulmamalıdır.

Anahtar kelimeler: Adölosan idiyopatik skolyoz, korse

Kanıt düzeyi: Derleme, Düzey V

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INTRODUCTION:

Scoliosis is defined as a three dimensional spine deformity involving an axial rotation together with a lateral deviation in the vertebrae, but its etiology has not been clarified yet with 70-80 % of the cases identified as idiopathic scoliosis^{30,42,56}. Idiopathic scoliosis is seen more in female and male adolescents aged 10-14 in their pubertal periods and curvatures of more than 20° occurring in girls at a rate of 1/5 are of more progressive nature^{37,56}.

According to the data of the National Scoliosis Foundation, an estimated 7 million people in United States, the reason for 600000 doctor visits in the USA is scoliosis and 30000 children are using braces and 38000 spinal fusion surgeries are being performed²⁰. In adolescent children, scoliosis-related surgery takes the second place after appendicitis-related surgery and its annual cost is around 518 million dollars⁵⁷. Considering the age group it affects, scoliosis is an important public health issue leading to various health, cosmetic, social and psychological problems associated with the deformity that occurs⁶⁰.

The purpose of operative and non-operative treatments in scoliosis is a pain-free and stable spine, a positive perception of the body and an active and high-quality life without any cosmetic worries. The prophylactic and non-operative treatments involve observation, bracing and exercising depending of the age of the adolescent and the angle of the scoliosis. The common opinion of the professionals working in both surgical and conservative treatment fields is that bracing should be used for girls with continuing maturation and preferably at their menarche and for children of Risser $0-2^{20,37,47}$.

Success in treatment depends not only on bracing criteria but also on applying a pattern specific brace designed in line with the site and angle of the scoliosis to the patient following correct biomechanical rules for an adequate period of time. The brace should be worn for 20-22 hours daily especially in the period when growth is fast^{37,47}. The bracing treatment should be continued until the maturity of the skeleton completes. When braces are being used, patients should be monitored by a physician specialized in this field, a physiotherapist and an experienced orthesis technician to make the necessary adjustments in time.

The generally accepted braces in scoliosis treatment are rigid thoraco-lumbo-sacral ortheses (TLSO) and very different bracing concepts are used today depending on the country in question. The purpose of bracing treatment is to prevent curve progression and to reduce the rate of surgery.

One of the hypotheses concerning the effect of bracing is that it provides mechanical support to the body as a passive delimiter as well as corrects the curvature by removing the body from the pressure area caused by the forces applied in the brace, thereby making an active component effect¹⁵. According to another hypothesis, braces enable neuromotor reorganization through their external corrective effect, delimiting movements and proprioceptive input¹⁵. The final goal is to modify the pathological spinal curve or to stop curve progression by means of the traction or external corrective forces applied in the brace.

There are still differing views on the efficacy of bracing treatment and the results of the studies on the issue are questionable^{20,57}. The results of recent randomized controlled studies, however, have evidenced that braces prevent curve progression and reduce the rate of surgery when correct bracing protocols are followed⁵⁷.

The purpose of this review is to go through bracing algorithms, bracing-related problems of parents and patients and the results of studies on the efficacy of bracing to establish a common approach among the professionals.

HISTORY OF BRACING:

A historical search shows that the longitudinal traction method was first used by Hippocrates in the 5th Century B.C. Galen, one of the students of Hippocrates, incorporated application of direct pressure to the brace with traction in the 2nd Century. The first really supporting brace was developed and used by Ambrose Paré (1510-1590). Towards the end of 1800s, Lewis Albert Sayre, the first orthopedic surgery professor in America, used the spinal traction method with a plastic brace to control spinal deformities^{11,22}.

Utilization of XR in radiology around 1895 and achieving good quality spinal radiographies towards 1830s accelerated studies in this field. Hibbs, who introduced his surgical technique in 1910 with the first spinal fusion operation on a patient who developed gibbus due to tuberculosis, used it in scoliosis surgery in 1914¹¹. He continued to implement the traction and bracing techniques he used for these patients preoperatively in the postoperative period to achieve fusion and to immobilize the spine.

In the beginning of the 20th Century, Lovett and Brewster used a full-time "turnbuckle" cast in scoliotic deformity. Risser modified this with a lighter and more functional model that better served the need of the patient. He also contributed to the identification of patients suitable for bracing with the classification known by his name, the Risser classification. Coming to 1950s, Ponseti and Friedman from Iowa University prepared surgical and non-operative guidelines for patients with adolescent idiopathic scoliosis (AIS). In this period when the natural course of idiopathic scoliosis and the risk factors for progression were better specified, surgeons came to know bracing treatment better and use it more often¹¹. In 1946, Walter Blount used the first cervico-thoraco-lumbosacral-orthosis (CTLSO) for scoliosis, also known as the Milwaukee brace for postoperative immobilization following a scoliotic surgery. This brace was then started to be used for non-operative treatment of AIS^{11,58}. Its pelvic part is custom made out of leather, its cervical part and anterior bar out of aluminum and its posterior bar out of rigid metal and pressure is created with the pads used in this brace (added pressure parts) (Fig.-1.a).

The Milwaukee orthosis was successful for thoracic and double-curve deformities. In its conventional model, the pelvic part of the brace was produced from prefabricated vitroten or polypropylene material. The cervical support in its original model was later modified due to the problems it caused in the tooth structure. After having been used in AIS for many years, this brace was abandoned in time for causing a decrease in lumbar lordosis of the users, having more passive effect and creating compliance problems in patients. Later, low-profile brace models made of lighter materials were developed, which had similar effect in controlling curve progression^{11,27}.

In 1969, Mac Ewen and associates from the Alfred Du Pond Institute developed the low-profile TLSO, which is known as the Wilmington brace and is still very popular today. For the production of this brace, which requires specific equipment and experience, measurements are taken using traction on a bed called the Risser Frame in supine position and a positive model is constructed from thermoplastic material. Still being used, this brace model is not recommended for high thoracic and rigid curves^{11,27,48}.

Modeling of braces showed changes in time in both Europe and the USA. The goal was to achieve a result that was effective and acceptable to the patient and that was able to exert pressure to the spine in three planes. The symmetrical Boston and Wilmington braces and the overcorrectionbased Providence and Charleston Bending braces, which are intended for night use only, are used more widely in the USA today. The bracing technologies in Europe provide a wide spectrum of braces ranging from full-time symmetrical lowprofile TLSO models such as Lyon, Sforsezco and Sibilla to asymmetrical models targeting more hypercorrection such as Cheneau, Rigo-System Cheneau and Genginsen. Braces that are custom produced using the Computer Aid Design Computer Aid Manufacture (CaDCaM) technology are used more widely¹⁴. The latest novelty in braces involves the manufacturing techniques using the 3D printer technology, which are visually more cosmetic, rendering more effective results, produced in a shorter time and less costly.

BOSTON BRACE:

John Hall and orthotist William Miller from Boston Children's Hospital designed a low-profile TLSO in 1972. This brace,

known as the Boston brace, is still one of the most widely used scoliosis braces. The major difference of this brace compared to the Wilmington brace that had been used until then is that it was not custom molded but prefabricated in different sizes that could be modified to suit the patient's deformity. Towards 1990s, the Boston group made some modifications in the brace in line with their experiences in order to achieve a better derotation of the spine and remodeled it for a variety of curves. The Boston brace allows standard symmetric model, lumbar and pelvic flexion and enables active and passive curve correction. While the apical pads used in the brace apply passive correction forces on the convex side, the open areas on the concave side allow active reduction⁹⁻¹¹ (Fig.-1.b).

It has been shown in studies that with its well-tolerated, standardized, low-profile features, the Boston brace, can produce, when used full-time, satisfactory results similar to those of the Wilmington brace in scoliotic individuals.

CHARLESTON AND PROVIDENCE NIGHT BRACE:

Designed to keep the scoliotic curve under control and to increase compliance with the use of brace, the Charleston bending brace is meant to be used 8-10 hours at night. This affects the adolescent self-image positively, increases compliance and prevents conflicts associated with the use of brace between the family and the child. In an overcorrection position, the brace theoretically stretches soft tissues and reduces the load on the vertebral endplate on the concave side of the curve¹⁹. Unlike classical TLSO, the reduction forces in the brace, which is made of rigid plastic, are applied as sidebending (Fig.-1.c).

Another night brace is the Providence brace. Alongside overcorrection, derotational and lateral forces are employed in the design of this brace to bring the curve to midline.

Both of these braces are more successful in flexible, single thoracolumbal and lumbal curves. In their study where they compared these braces to the Boston brace, Katz et al. reported that results similar to those of full-time Boston braces could be obtained with the night braces in curves up to 35° and particularly in single curves^{19,23}.

SPINECOR BRACE:

Developed by Charles Rivard and Christine Coillard in Montreal Saint-Justine hospital, the SpineCor brace is a dynamic non-rigid brace that was put into use after 1998. It is based on the hypothesis that the postural disorganization, muscular dysfunction and unsynchronized spinal growth that occur in scoliosis can be prevented with the controlled movements in the brace. The brace consists of a thermoplastic pelvic base, a cotton bolero and four corrective elastic bands in varying sizes (Fig.-1.d).



The bands are placed and stretched according to an algorithm taught to the clinician depending on the place of the curve. The non-rigid positioning of the brace under clothing is preferable for patients. It is recommended to use this brace full-time and until the skeletal maturity is completed as in other braces. The best results are reportedly obtained especially in small, single, structural thoracolumbal and lumbal curvatures⁴⁶. However, determining the corrective movements, sufficient experience and problems arising from the user are important matters to be kept in mind. A retrospective study made by Gutman and associates indicates increased curve progression and risk of surgery in children using the SpineCor braces¹⁶.

CHENEAU AND CHENEAU DERIVED BRACES:

The thermoplastic Cheneau brace was developed by Dr. Jacques Cheneau and was given the name Cheneau-Toulouse-Munster Brace. The corrective principles in the brace are explained by both passive and active corrective mechanisms. Accordingly, the corrective effect on the scoliotic curve is described as transfer of tissues from the convex side to the concave side through passive correction and a three dimensional control through maximum correction of the curve. Removal of the load on the elongations and vertebras and derotation of the thorax are also possible. The active mechanisms include asymmetrical support with the effect of respiratory movements, repositioning of trunk muscles to restore physiological position and antigravity effect^{25,58}. The correction pads in this brace, which is opened from the front, are not placed in symmetrical plastic cylinders as in the Boston brace and some other braces but are designed directly into a positive cast model. The first patient results of the brace were disclosed in 1972 and presented in Bratislava in 1979. The skill of the technician is very important in this brace that requires a three dimensional modeling depending on the site and degree of the curve based on the mold taken from the patient.

Apart from modeling, there have been developments also in the design and manufacturing of the scoliosis braces in line with recent advances in technology. High quality Cheneau model derivate braces of different types were developed using the CaD CaM modeling and the expert-based brace library.

The best known Cheneau derivative models are the Ortholution Rigo system Cheneau, Gensingen brace, Regnier Gmbh and Sanomed Orthopaedie models, which are widely used in European countries (Fig.-1.e). Their use is increasing also in America, Japan and Far East.

The results of many studies made with Cheneau brace models indicate that the brace is quite effective in controlling scoliotic curves. The studies on this subject are explained in more detail further on under the heading Brace Results and Brace-Related Studies.

The basic biomechanical rule in scoliosis braces is to normalize the deformed spine with overcorrective external forces applied through using the brace and to take control over the deviation. In a well-designed brace, the forces in the coronal, sagittal and transverse planes are generally controlled simultaneously. The iliac cristae are the contact points used to position the lumbar spine whereas the costae and sterna are good control points for thoracic spinal deformities. The flexible spine is brought under control with the moment effect that is based on the three-point principle in the coronal plane. The lateral forces applied to the apex of the convexity where the curve is are balanced with contralateral forces under and above the apex. While the upper margin of the coronal plane is the axilla, its lower margins are the pelvis and the iliac cristae. The sternum, the upper point of the vertebra and the pelvis are taken as the basis for deviations in the sagittal plane. Normal lordosis and kyphosis control is achieved in this plane. For deformities in the transverse plane, forces from extra local pads to be applied from transverse processes are used to limit the increased rotation in sterna and costae in the thoracic area and in the axillary lumbal region²⁵.

After all, the external forces targeting to control the curve in three specific planes should be designed in a way that they will not cause other problems in the user while controlling the flexible spine (Fig.-1.e).

AIS BRACE INDICATIONS:

It is still difficult to say that there is a consensus among health professionals about the use and outcomes of bracing in adolescent idiopathic scoliosis. Braces are more widely used and the set indication limits are more observed in the countries where bracing techniques are more developed and a health refund system is in place. Although the developments in surgical methods reached contemporary levels in our country, we cannot say the same for bracing practices, which can be considered as one of the conservative treatment methods. The orthesis technicians in Turkey are still not well acquainted with scoliosis and are not skilled enough at scoliosis bracing practices. Considering that the compensation allocated by the social security agency for a scoliosis brace in Turkey is around 70 USD, the reasons for the insufficiency of employing bracing and the unwillingness to use advanced technologies can be understood. This also makes the physicians who prescribe scoliosis braces lose their confidence in braces. Due to models that do not produce good results and do not satisfy users cosmetically, the physicians in our country seem to keep the brace indication range narrower than generally accepted limits.

The commonly agreed rule for the use of a trunk brace in AIS is being a growing immature child and having a curve between 25 and 40 degrees. The treatment options recommended according to the degree of scoliosis and the maturity of the child as also accepted by the Scoliosis Research Society (SRS) are given in the table below (Table-1)⁴⁷.

The conservative treatment report 2006 of the International Scientific Society on Scoliosis Orthopedic and Rehabilitation Treatment (SOSORT), Guidelines Committee stresses that each case has its own natural course and any conservative treatment should be planned in view of the individual condition of the patient. Observation is recommended in scoliosis less than 15° before the onset of maturity and use of a brace in immature individuals with scoliosis over 25° by also

identifying the risk of progression. Part-time and full-time brace use as well as a rehabilitation program is recommended for adolescents of Risser 0-3 with a progression risk of 60 % and more⁵⁹ (Figure-2).

Table-1. Indication for treatment of the scoliosis curve			
Risser	Curve	Action	
0-1	0-20°	Observe	
0-1	20-40°	Brace	
2-3	0-30°	Observe	
2-3	30-40°	Brace	
0-3	40-50°	Gray	
0-4	50-Higher >50°	Surgery	



Despite the guidelines recommended by SRS and SOSORT, physicians seem to follow different indications in brace use in line with their own experiences. In the review they published, Richard et al. point out the differences in the ranges of indications in the clinical studies on braces. According to their review, as an optimal inclusion criterion, adolescents aged 10 and over, with Risser 0-2 and whose primary curve is 25-40°, and if a girl, who is in her pre-menarche period or not older than post-menarcheal year one are more suitable for a brace¹⁸.

When deciding on a brace in AIS, the generally accepted criteria should be followed, but whenever broader indications are used for using braces in special cases, the patient specific conditions should be expressly disclosed. Considering the highly evidenced bracing results in recent years, it should be borne in mind that some professionals' approach to keep away from braces is also controversial for patients.

BRACE PRESCRIPTION AND MANUFACTURING STANDARDS:

Even when acting on common grounds in brace indication in AIS, professionals have to find solutions to various problems that arise during bracing treatment. These include measurement and manufacturing techniques, correct design, implementation, duration of wearing, materialrelated problems, bodily changes in a growing child and the algorithms of monitoring and check-ups. A physician who prescribes a brace should try it on the patient after the technician finishes the brace. In Europe and America, some of the orthesis technicians have specialized in scoliosis; they can model one or more braces technically well and fit them on patients. Unfortunately, this is not the case for Turkey; we, as physicians do not have the same chance. Therefore, physicians should question the knowledge and experience of their technician with respect to braces and should hold themselves also responsible for the results.

In a successful bracing practice, besides selecting suitable patients, using standard braces that are biomechanically correctly designed and manufactured from appropriate material is also important. When readymade braces are to be used, a brace that is specific to the pattern of the scoliosis should be chosen and it should be modified to suit the patient. In custom made braces either using plaster molds or the new technology CaDCaM, the orthesis technician should be experienced enough to complete the design of the brace in the best way so that it fits the scoliosis site and apex, and the patient's body. Due to the problems in this area, SOSORT has developed standards and recommendations in its bracing guidelines for both physicians (MDs) prescribing braces and monitoring the conservative treatment and technicians (CPOs) manufacturing the braces. The aim is to increase the success of conservative treatment³⁸.

According to these recommendations;

The MD responsible for the treatment has to be experienced and should fulfill all these requirements: 1. training by a previous master (i.e. MD with at least 5 years of experience in bracing) for at least 2 years, 2. at least 2 years of continuous practice in scoliosis bracing, 3. prescription of at least 1 brace per working week (~45 per year) in the last 2 years, and 4. evaluation of at least 4 scoliosis patients per working week (~150 per year) in the last 2 years. Conservative treatment performed by physicians who have the above training and experience will reportedly be more successful.

The CPO should fulfill the following requirements; 1. working continuously with a master MD (i.e. a MD fulfilling recommendation 1 criteria) for at least 2 years, 2. at least 2 years of continuous practice in scoliosis bracing, and 3. construction of at least 2 braces per working week (~100 per year) in the

last 2 years. It is stressed that trainings should be provided to CPOs so that they become qualified and skilled enough in terms of practice and experience³⁸.

Conservative treatment requires team work. The physician, CPO and therapist should implement a treatment program focusing on the best result for the patient in a interdisciplinary way by including also the patient and their family in the team. The education of CPOs in our country is obviously insufficient in this sense. These deficiencies can be eliminated through Category 1 and 2 completion trainings that are being carried out in many countries by the International Society of Prosthetics and Orthotics (ISPO). Completion of these trainings and practical works that are needed to catch international standards in also developing countries with the incentives of CPO vocational organizations and health administrators will certainly provide positive contributions to physicians' practices and patients.

BRACE FITTING, CHECKING AND CONTROL:

A brace must be fitted to a patient in supine position, the legs in flexion from the hips and posterior tilting of the pelvis completed so that it fully fits the pelvis. The belts of the brace should be tightened in a way to allow a slight flexibility during active breathing in controlled-respiration and not to create any problems for daily activities of the patient. The middle ratcheting buckle is checked at the chondro-costal level. The tightening of the lower ratchet closure does not compress the abdomen, but stabilizes trochanters. Upper velcro closure must be tight enough to prevent the tingling in the upper limbs (Fig.-3).

When the brace is first fitted, the patient should be asked to sit and walk with the brace on for a certain period of time. Afterwards, it will be appropriate to take off the brace and check the whole body. After the last necessary adjustments are made for sites under excessive pressure and disturbing forces, the protocol for wearing, taking off and using the brace should be explained to the patient and their family in detail.

The child should be clinically observed in brace from the coronal and sagittal perspectives to see if the central sacral line (CSL) is aligned with the middle line and how the sagittal pattern is and photographic records should be taken to be kept for follow-up (Fig.-4).

Clinically, the height of the child in brace is measured, because the gain in height is an average of 1.58 cm due to the untwisting of the spine. This is an excellent clinical indicator of the effectiveness of the brace. In the sagittal plane, alignment of Tragus – Acromion – Trochanter – Ankles is checked³⁴.

After fitting the brace, frontal and sagittal XRs should be taken to examine the effect of the brace on scoliotic spine and necessary adjustments should be made. Different approaches are seen in this matter in practice. Some physicians prefer to take XR immediately after the brace is fitted and some others 3-4 days later^{34,60}. Yet, some implementers in Europe prefer to take XRs 4-6 weeks after the use rather than when it is first fitted. In this way, they allow sufficient time for the adaptation of the body to the brace and for cosmetic effect through proprioceptive input. It would be useful to place metal markers

in plastic braces before taking XRs to better analyze the pressure points of the brace and to see if the axillary endpoint is at the right point in the brace. It should be checked, when necessary, whether there is any secondary upper thoracic and cervical deviation occurring due to high axillary endpoint and if there is, it should be corrected (Fig.-5).



Figure-3. Brace fitting



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Figure-5. Xr control after 4-6 weeks

The first effect 4-6 weeks after the use of brace is the change in the cosmetic pattern of the body and its inclination towards the correct posture. The photographic and radiological images before the use of brace and 4-6 weeks after also affect the patient compliance positively. The results should be shown to the family and their child to enhance their motivation. Undesired problems arising in the body due to the brace should be eliminated and the child should be made comfortable in the brace.

A brace produces more successful results in flexible curvatures. The studies made on this subject mention that the first effect in the brace is a determinant for the success of the treatment⁶¹.

Utmost care should be taken to protect children using braces from radiation in radiological follow-ups. Due to problems that may arise from x-rays in the breasts and other organs of growing children, professionals should consider low-dose radiation and use, when possible, topography or EOS lowdose systems. During bracing follow-ups, the child's height and weight should continuously be monitored and extra pads should be added, if necessary, for sufficient corrective forces to enable derotation. If the brace should be replaced in line with the physical changes in the child, the decision should be made according to the body measurements during followups. Another issue is to replace ineffective or incorrect braces without delay.

Adolescents using braces should be checked by the physician in 4-6 month intervals after the first check-up and if there is no negative finding in physical examinations and Bunnel scoliometer measurements, frequent radiologic procedures should be avoided. The Tanner stages for the pubertal development of the child, and menarche and height gain in girls are important markers, which should be recorded in detail in check-ups.

BRACE WEARING PROTOCOL AND MANNER OF USING A BRACE:

The protocol that is recommended in brace use and has been evidenced to be effective is full-time use of the brace, that is, not less than 20 hours a day, particularly in adolescents in their Risser 0-2 periods. Many studies have shown that the positive response derived from a brace is a dose-response^{23,38,47,57}. Curve progression control and surgical treatment limit noticeably change in adolescents using their braces for 16 hours and longer^{23,57}.

Although continuing to use the brace half-time from Risser 2 until Risser 4 seems to produce positive results for the scoliotic curve and body cosmetics, there are no study results comparing the outcomes of children wearing and not wearing braces during this time. Families should be informed in detail about starting and continuing to use braces and to overcome the initial difficulties, the duration should be gradually increased until full-time use is secured. To improve the child's compliance, care should be taken to allow them flexibility for personal requests, school exams and special days.

When the brace is removed, performing personal hygiene, exercises and sporting activities is recommended.

Sporting activities are useful to relax the tension in the muscles, because the paraspinal muscles in particular are active when sporting and this protects the spine from collapsing.

PATIENT COMPLIANCE AND OTHER BRACE PROBLEMS:

Using scoliosis braces causes some unwanted problems in adolescents, which may relate to appearance or material. These include dermatological problems, pain, abdominal cramps, intestinal complaints, sleeping problems and psychological and social problems⁴³. One of the major problems regarding braces is patient compliance. The perception of the body and cosmetic concerns associated with both the scoliosis and brace bring about a very important problem for adolescents. This also adversely affects the child's relationships with their social environment, friends and parents. Braces that are defective, not suitable for the body or have become small may cause other asymmetries in the body, difference in the breasts, numbness in the arms due to axillary pressure, swelling in the arms or on the skin due to pressure, weakness and cramps in the muscles and deformities in the costae. Besides discomfort during sitting, lying and other daily activities, restrictions in using clothes affect the adolescent negatively. Since the child's perception of his/her body is negatively affected due to both scoliosis and brace, the physician and the family should provide professional support when necessary to protect the child's selfesteem. The results obtained from the brace partially decrease such negativities44.

Some studies have shown that quality of life, body image, and emotional and social conditions are affected in especially children using braces full-time⁷. Some other studies report conversely that braces do not create a major problem on quality of life⁵⁴. Ugwanali et al. have questioned quality of life in 214 subjects with adolescent scoliosis using the Quality of Life Measures Child Health Questionnaire and have shown that braces do not affect quality of life negatively⁵⁴. In their BRAIST study, Schwieger et al. compared adolescents who used a brace for 6 hours or less with those who used one for 16 hours and longer using the Spinal Appearance Questionnaire and PedsQ, scale for quality of life in children, and they found no statistical difference between the two groups⁵².

In a study where the emotional stress levels of families and their children were compared with respect to scoliotic deformity and brace use, it was shown that stress was associated more with body deformity. In a severe spinal deformity, a poor psychosocial outcome is said to be associated with the patient's age and the duration of using the brace¹³.

BRACE RESULTS AND BRACE-RELATED STUDIES:

Studies with long follow-up periods relating to the effect of braces on adolescent idiopathic scoliosis started to appear in the literature towards the end of 1970s with the Milwaukee brace in line with historical development of braces. The results of the nearly 5-year lasting follow-up study of Carr et al. on 133 patients with adolescent idiopathic scoliosis who used Milwaukee braces revealed that success was high and the need for surgical intervention dropped in children who had scoliosis of 40 degrees and less and who well responded to the brace in their first year⁴. The results of the study made by Loenstein and Winter on 524 patients using Milwaukee braces showed that the brace was successful in scoliotic curves of 20-29 degrees and the natural course remained unchanged beyond this angle range²⁹. It was reported in another series with 111 patients using Milwaukee braces where the same authors also participated that the natural course of scoliosis did not change despite the use of braces³⁹. Another important problem concerning a Milwaukee brace is the orthodontic problems it causes due to its neck ring^{31,40}. It has also been shown to negatively affect the sagittal profile and increase hypokyphosis²¹.

Following the results of 295 Boston brace users regarding the effect of this brace on scoliosis, which was published by the Boston brace developers in 1986, many studies were published on this subject between 1993 and 199855. The results of 40 adolescents with idiopathic scoliosis who used Boston braces showed that the brace decreased the angle of scoliosis in the frontal plane, but it proved ineffective in three dimensional effect, especially in the rotation of the thoracic apical vertebrae and in spinal balance. Its negative effect in the segittal plane by noticeably decreasing thoracic kyphosis was noted in particular²⁶. The common results of the studies on the use of Boston braces indicate that the brace produces successful results and reduce the need for surgery in appropriately selected patients in Risser <2 whose curve is 25-45 degrees when they wear them for a long time and their compliance is good^{49,57}. As in other braces, the Boston brace produces better results when it is used longer than 12 hours a day²³.

The results of the studies made with the Providence and Charleston braces show that night braces are also effective in controlling the progression of scoliosis, they even produced similar results to those of full-time TLSO braces and controlled progression at a rate of 60-70%. Contrary to these results, other randomized controlled studies have evidenced that when the duration of wearing a brace increases, the success of the treatment also increases^{3,23,35,53}.

The Chenau and Chenau derivative braces, which are curve pattern derotation braces, are widely used in Europe. These braces are manufactured mostly using the CaD CaM technology in recent years. It has even become possible today to produce a brace without any need for other procedures after designing it owing to the CaD design 3D printer technology, which shows that this technique will be used more in the future for manufacturing braces. The results of the clinical study made by Maruyoma et al. on 33 adolescents of Risser <2 who used Cheneau braces demonstrated that 76 % curve stabilization could be achieved in these subjects who were followed up until their skeletal maturity³². The studies on the Cheneau braces in the literature show that a Cheneau brace controls the sagittal plane as much as the frontal plane and makes a positive effect on the postural balance with its action on the trunk when standing and walking⁴¹.

The results of the retrospective study of Rigo et al. on 105 patients with idiopathic scoliosis who had been treated with Cheneau braces indicate that Cheneau braces are effective in primary correction of scoliosis and can prevent the Cobb and distortion angles⁴⁵.

Braces conforming to correct biomechanical rules have been shown in the results of various researchers to be effective in Cobb angles less than 45 degrees in immature subjects with idiopathic scoliosis and to reduce their need for surgical fusion. Besides retrospective studies, the results of recent prospective studies involving long-term follow-ups have also demonstrated that braces prevent progression.

The results of the observation and multicenter study randomizing 242 subjects with idiopathic scoliosis as the brace treatment group of Weinstein et al. showed that the use braces decreased curve progression and lowered the surgical threshold and it proved to be a study supporting the confidence in braces⁶.

Another argument about use of braces and its results is that scoliosis has its own natural course in each patient, therefore, scoliosis may not progress up to the surgical limit in a group of subjects who receive no treatment whatsoever. Sanders et al. have investigated the number needed to treat (NNT) to prevent one surgery in 126 patients with AIS who used Boston braces and whose length of use and compliance were monitored by way of heat sensors. They found in the end that compliance was important in using a brace, longer daily uses reduced the risk of progression that would necessitate surgery, but even when no brace is used, most of the patients did not reach surgical limits⁴⁹.

We see that the discussions on the role of braces in treatment and treatment criteria still continue. This is because a natural course for individual cases cannot be predicted as to in whom, why and to what extent scoliosis can progress. Another problem concerning researchers relates to the difficulties involved in long-term studies that can take into consideration many issues such as selection of subjects with the same natural course, ethical problems in randomization and brace compliance. The 662 studies in the meta-analysis made by Negrini et al. had varying results. Alongside the results suggesting that braces prevent progression, there are also study results stating that braces have no effect on quality of life. Authors who point out the problems in randomization for treatment in the studies made in this field also stress the importance of exploring the effects of braces, their side effects and compliance issues through long-term, well-planned prospective studies³⁶.

New, highly evidenced studies regarding the efficacy of braces in scoliosis show that correct and standard braces prevent the progression of scoliosis and reduce the incidence of surgery in subjects with adolescent idiopathic scoliosis when algorithms are strictly followed and braces are used full-time. Despite such evidences regarding the effect of braces, the child's compliance with brace use and psychosocial problems still remain to be overcome. The decision to use braces in children who have the option of a low-cost treatment to protect their spine from surgical fusion should not be left solely to their own initiative. Efforts should be made to prevent conflict between the family and their child due to use of brace and professional support should be sought when necessary. Adolescents can accuse their families in their later years of not insisting on the treatment despite the decision they had made in their adolescence under the influence of their psychosocial standing. For this reason, support should be provided to those parents who disagree with many decisions of adolescents for their own sake and who try to protect them from future problems as their own experiences dictate. It should be kept in mind that increased awareness of scoliosis and early diagnosis will improve the success of conservative treatment.

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PROF. NECDET ŞÜKRÜ ALTUN, M.D.

PROF. DR. NECDET ŞÜKRÜ ALTUN

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¹Prof. Dr. Orthopaedic Surgery and Traumatology Specialist, Okan University Faculty of Medicine Hospital, Head of Orthopaedic Surgery and Traumatology, Tuzla, İstanbul SUMMARY

Prof. Dr. Necdet Altun was born in February 13, 1957, in Artvin. In 1975, he started his education in Ankara University Faculty of Medicine. He started his speciality education in Gazi University Faculty of Medicine, Department of Orthopaedic Surgery and Traumatology. In May, 1987, he became specialist and one year later, he turned back as assistant professor to the clinic where he became specialist. In 1994, he became associate professor, and professor in 2000. He became founder and developer of Spinal Surgery in Gazi University Faculty of Medicine, Department of Orthopaedic Surgery and Traumatology. He conveyed his knowledge and accumulation about spinal surgery in various cities of United States of America and Europa. For a period of time, he was in board membership of Turkish Spinal Association. In this period of time, he published his "Degenerative Spinal Diseases" book that he performed its editorship with Tarık Yazar. He was assistant of Mr. Emin Alıcı who is founder and editor of our journal which is media organ of our association for a long time. He performed co-chairman duty of Tenth Turkish Spinal Congress. Prof. Dr. Necdet Altun who had many international publication, trained many students and Orthopaedic Surgery and Traumatology Specialists and Spinal Surgeons. After 2005, he started to work with Prof. Dr. Ali Şehirlioğlu. Prof. Altun is a real frontier of Turkish Spinal Surgery with his scientific contributions and for everyone he is a close friend and he is holded in high honor in Spinal family by being warm-heartedness, the most colored and the most heartfelt person with his social aspects and personality.

Key Words: Prof. Dr. Necdet Altun, Degenerative Spinal Diseases, Tuberculosis spondylitis, Scoliosis, Gazi University Faculty of Medicine

Proof Level: Biography, Level V.

ÖZET:

Prof. Dr. Necdet Altun, 13 Şubat 1957 günü Artvin'de doğdu. 1975 yılında Ankara Üniversitesi Tıp Fakültesine başladı. 1982 yılında Gazi Üniversitesi Tıp Fakültesi Ortopedi ve Travmatoloji Anabilim Dalı'nda uzmanlık eğitimine başladı. 1987 Mayısında uzman oldu ve uzman olduğu kliniğe 1 yıl sonra yardımcı doçent olarak geri döndü. 1994'de doçent, 2000 yılında profesör oldu. Gazi Üniversitesi Tıp Fakültesinde, Ortopedi ve Travmatoloji Anabilim dalında Omurga Cerrahisinin kurucusu ve geliştiricisi oldu. Amerika Birleşik Devletleri ve Avrupa'nın çeşitli kentlerinde omurga cerrahisi konusundaki bilgi ve birikimini artırdı. Bir dönem Türk Omurga Derneği yönetim kurulu üyeliği yaptı. Bu dönem içinde, Tarık Yazar ile birlikte editörlüğünü yaptığı "Dejeneratif Omurga Hastalıkları" kitabını yayınladı. Uzun süre derneğimizin yayın organı olan dergimizin kurucusu ve editörü Emin Alıcı Hocamın yardımcılığını yaptı. Onuncu Türk Omurga Kongresinin eş başkanlığını yaptı. Birçok uluslararası yayını olan Prof. Dr. Necdet Altun, birçok öğrenci, Ortopedi ve Travmatoloji uzmanı ve Omurga Cerrahı yetiştirdi. 2005 yılından sonra Prof. Dr. Ali Şehirlioğlu ile birlikte çalışmaya başladı. Prof. Altun, bilimsel katkılarıyla Türk Omurga Cerrahisinin gerçek bir öncüsü ve sosyal yönleriyle ve kişiliği ile en renkli, en candan kişisi ve sevgi dolu oluşuyla Omurga ailesindeki herkesin yakın dostu ve baş tacıdır.

Anahtar Kelimeler: Prof. Dr. Necdet Altun, Dejeneratif Omurga Hastalıkları, Tüberküloz spondilit, skolyoz, Gazi Tıp.

Kanıt Düzeyi: Biyografi, Düzey V.

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INTRODUCTION:

Prof. Dr. Necdet Altun was born in February 13, 1957 in Artvin. In 1975, He started his education in Ankara University Faculty of Medicine. In 1982, he started his speciality education in Gazi University Faculty of Medicine, Department of Orthopaedic Surgery and Traumatology. In May, 1987, he became specialist and one year later, he turned back as assistant professor to the clinic where he became specialist. In 1994, he became associate professor, and professor in 2000. He became founder and developer of Spinal Surgery in Gazi University Faculty of Medicine, Department of Orthopaedic Surgery and Traumatology⁹.

I knew Prof. Dr. Necdet Altun during my assistantship. Together, we went to Texas Scottish Rite Hospital in Texas, Dallas city. Approximately for two weeks, we worked together, entered operative surgeries, attended courses. This trip made me understand that he is such a good person, humorous and full of love, and led me love him as my own elder brother, and it did not happen only because he is from Artvin, it means that he is my fellow townsman (Figure-1).



Figure-1. Prof. Dr. Necdet Altun and I (Prof. Dr. İ. Teoman Benli) in Texas Scottish Rite Hospital, 1989.

Together, we organized joint courses with SSK (Social Insurance Institution) Ankara Dışkapı Hospital and Gazi University. It was the first in the history of SSK. Together, we entered Managing Board of Turkish Spinal Association. In this period, we, together, became *assistant editors* of "*The Journal of Turkish Spinal Surgery*" which is official media organ of our association and we published all issues of journal up to 2005, we provided regular publication of the journal. Again in this period, in 2006, we published "Spinal Infections" book in my editorship and "Degenerative Spinal Diseases" book which Prof. Dr. Necdet Altun undertaken editorship with Prof. Dr. Tarık Yazar^{4,6}. This year, we made extended and updated publications of same books^{7,8}.

He started to work with Prof. Dr. Ali Şehirlioğlu after 2005. Prof. Altun is a real frontier of Turkish Spinal Surgery with his scientific contributions and for everyone he is a close friend and he is holded in high honor in Spinal family by being warm-heartedness, the most colored and the most heartfelt person with his social aspects and personality.

BIOGRAPHY:

Prof. Dr. Necdet Altun was born in Veliköy which is a town in Şavşat district of Artvin in February 13, 1957 (Figure-2).

His father was the manager of Veliköy that was township once, at that time. He started his primary education in Muratlı town of Borçka district of Artvin. After 1960 coup, his father was assigned to this township which its old name was Maradit (Figure-3).

The very first memories of Prof. Altun are belong there. I would like to share some sections that he wrote for a journal about what he lived through⁵.

"Yuri Gagarin, President Kennedy and Maradit":

A side ripped black and white photograph. The date is 1963, the place is Maradit (Murath), I am six years old. A button-front, tight-fitting jacket on me, it is crumpled, my knickerbockers, front belted plastic shoes on my feet. My sister is in the middle, with her French braid hair on both sides, she has a side laced dress on her. Right next to her, my uncle's son is there, with a similar wear with mine. This is my oldest photograph, there is nothing about before. My memories are also like this. The things that I can remember before the date of this photograph, are very obscure. But it is not known whether it is with the effect of this photograph or not, the memories that belong to my six years old, are still in memory with their all freshness.

Maradit... The first things that I remember about life, belong there. A small township center. It was built on a very green slope that lies toward Çoruh with a nice gradient, red colored roof tiled houses that were interspersed among hazelnut and tea gardens, narrow and twisted road between cornfields and Çoruh River that streams murky with a great howl. Opposite shore of Çoruh is Russia, another Maradit at the opposite shore, like a reflection on the mirror, almost same.

A small brook that stream from the hills by twisting, was dividing township into two parts. Highway that comes from Borçka, was reaching the square, a wall of a school at the right upper of square, was facing with the brook. There was a wooden minaret mosque at the right of square, right next to mosque, there were building of township management and PTT. Right next to them, there was the shop of Hüseyin (Gezmiş) uncle. Opposite the

square, there were village coffee house and a few more shops.



We were living on border, in a narrow geography where it was compressed by another country and Çoruh, at the slope of a mountain. I was six, my world was also small as my age. The biggest adventure for me, was going to Borçka with hand starting jeep of uncle Sadık. There was nothing more for me. The beyond was bordered by Çoruh. Besides, there was another country at opposite shore.

My father was manager of township. It was our third year in Maradit. Our home was a big one that can be reached by climbed up by using a narrow walkway which reaches up by twisting up. We were living at a half and İskender Granddad (Dizdar) at the other half. Our home had a small kitchen and another two rooms. One of them was facing with back garden and the other was facing with walkway. From the window, at the behind of tea and hazelnut gardens, Coruh River and village at Russian side, slopes and hills, could be seen. There was a camellia at behind of locust tree at the end of the garden. In hot summer nights, in shaky light of pressure lamp, deep conversations were being made, teas were being drunk, cookies and mine pies of my mother, were being ate. Conversations were being cut by starting of news on radio, my father wand İskender grandfather were listening news carefully. After the end of news, folk songs from Yurttan Sesler Chorus or chorus and solo songs were being started. The voice of the down brook mix in the singing voice that comes from radio, and it was becoming a nice melody with incorporation of voice of crickets. When evening was turning into night, with the effects of cool wind that comes from brook or with the end of the gas of pressure lamp, camellia joy was being ended.

Radio was the most reputable belonging of homes. It had the seat of honor. Absolutely, there was a handicraft cover on it. In the beginning, we had a radio with an enormous batter. I can remember radio's battery but not its shape. Later on, we had a front buttoned, battery-operated "Sierra" brand radio. There was Ankara Radio, a Turkish broadcast radio, among many stations that make broadcast in Russian. Its sound was so weak and powerless comparing with other stations. There was The Voice of America Radio that makes Turkish broadcast in particular hours of day, through shortwave. News hours were important. So to speak, the flow of day was being arranged according to news hours. Before it started, people were sitting right next to radio, and it was being listened carefully until it ended. There was not any other way to have communication with the rest of world in this hid end of creation.

Life Journal was coming once in a month. I knew world leaders, important people, Yeşilcam and Hollywood artists. Radio and Life Journal were far away from audial and visual technology of our day but they became an unchangeable part and architect of my memories.

While darkness was falling in our side in the evenings, electric power light on at the other side, its light was blinding us, its flash was lighting our walls. While we were sitting at the light of gas lamp, sometimes a spotlight was scanning our homes, it was coming into our rooms from windows, everywhere was getting light for a few seconds, than it was falling into darkness again.

Music broadcast was being made from the other side in day times. Mostly, a bass man voice was singing songs that never like ours, in a language that I do not understand.

I had a significant curiosity about opposite side. We were living at two shores of one river, but they were different. They had electricity and bright lights that enlighten night. They had strong voices that suppressed our radios, they had songs that I could not understand. With this curiosity, sometimes I was going to shore, I was watching the opposite shore among trees by having afraid a little bit. Sometimes, I went up to minaret, I was trying to see people with fixed binoculars. Mostly, people were not seen around. Sometimes, I was catching a shadow, and lose it, until I make clearness adjustment.

Opposite side was mysterious for me.

As it was required by my father's duty, from time to time, meeting were being done with Russians. Committees of both sides were gathering in protocol building at border, sometimes, they were doing some works that take around a few days, at land for determination of border. My father was chairman of Turkish side, and a Georgian, Kahidze was chairman of Russian side. Because İskender Granddad exist as translator in committee, this meetings were being mentioned a lot at home conversations. I was the most curious listener of this conversations.

A summer day, when my father said that he will take me to one of this meetings, I was so happy and excited. Finally, I will be able to satisfy my curiosity. Maybe, it was my first dream that came true, my first discover, my first passing borders, my first meeting with people who have different language and religion. I could not sleep at that night. In the morning, my mother put my clothes on me. We met with the other members of committee in township building. I think we were around for or five. We went to protocol building at the border. Protocol building was a one floor white building among exuberant chestnuts at the side of the river. There was a brook a little away from building where a wooden bridge existed. The other side of bridge was Russian land. There was one of our soldiers who was on watch. Meeting was going to make at Russian side. When we arrived bridge with the company of protocol officer, soldier made a formal salute. No one was seen at the other end of bridge. When we walked up to middle of bridge, a Russian soldier showed up among trees in opposite side and started to approach us. I was so excited, I think I was a little afraid too. I remember, I get closer to my father and hold his hand. It was very important moment for me, first time I was seeing a foreigner. Besides, this person was a man who had bright lights, projectors, grand bass voices.

By approaching, I was trying to see how he looks like. Actually, he was not different from us. He was a little tall, a little brighter skin than ours, blue eyes, and golden hair. When he arrived, he saluted us. They spoke in a language that I do not understand with İskender Granddad. His voice was not bass or grand, it was just like ours. He take forward, we followed him. Along with shore, we walked for a while on a narrow road among trees. When we arrived a small square, four or five Russian with uniforms, stand up from camellia and walked toward us. The older one among them, handshaked with my father with a significant warm and smile. My father turned to me and said "This is Kahidze!". The man stooped and tweaked my cheek and fondled my hair. I remember that my spindle shanks were shaking. The one who I overrated, touched me, it was my first contact with someone who is not one of us. We sat on camellia, meeting was started with the translatorship of İskender Grandpa. Even they are talking in different languages, my father and Kahidze were like two old friend. I do not remember what was talked, what was eaten. I was in different feelings. I was discovering a different world than mine, I was among people who I watched within a curiosity and I tried to see by using binoculars.

When formal meetings were ended, cigarettes were smoked. I think, ours were smoking Bafra cigarette. There were a name on theirs that its most letters were written reverse. There was a conversation between my father and Kahidze with translatorship of İskender Granddad. The things that were spoken in a part of conversation, significantly attracted my attention. I do not know how they ended there, in a moment, my father said to Kahidze "Even we have different prophets, we have the same God". Kahidze said something. İskender Granddad said to my father "He says he does not believe in God". Kahidze were keep talking: "I believe nothing I do not see, if there was a God, Yuri Gagarin would have seen him when he went to space". I could not believe my ears, did I hear wrong, what was this Russian telling? Was it true? Who was Yuri Gagarin or what? Did he go to space? How and when? (Figure-4).



Figure-4. The first cosmonot Yuri Gagarin

It was the most extraordinary thing that I heard up to that moment in my very short life. As soon as we turn back to Maradit, I asked my father whether it was true. It was. Two years ago, a Russian man named Yuri Gagarin went to space and came back. What I heard, was unbelievable for someone who born in Veliköy of Şavşat and maintains his life in uttermost point, Maradit but it was real. While I was still trying to discover opposite shore, they discovered the space.

Meeting with Yuri Gagarin, was affected me more than any other excitement that I lived at that day.

At that day, my little tiny world extended as much as much reaching the space.

This time, I lived a similar excitement in Şavşat in 1968. We were again by radio, we were witnessing the first step of human being on Moon from the intermittent weak voice of Voice of America Radio. The trip starting from Cape Canaveral of Neil Armstrong and his companies and their arriving to Moon, was one of the most important events of the history of humankind. After many years, in America, I went the place where this trip started. I walked around space station. I turned back to my childhood, to Maradit, in control center of the first travel to Moon, I remembered Kahidze and Gagarin again.

I again lived my childhood this time in America in Dallas. I again turned to my childhood, to Maradit, when I came to crossroads of Houston and Elm streets where Kennedy assassination was realized. It was November, 1963. Leaves of apple tree turned pale in tea garden that was seen from the window of our home, it was a lovely autumn day. I remembered my father by radio. He was listening Voice of America Radio carefully. The news was very important. President Kennedy was shoot in Dallas. I knew handsome President of America and his Beautiful Wife from The Life Journal. My father found that journal and we get upset again by looking at photos. After many years, I again lived that moment on where Kennedy was shot. (Figure-5).



Figure-5. a) John Kennedy, Democrat President of U.S.A who was assassinated b) He is with his wife, a little before he was shot.

35 years later, I went to Maradit again. I had a great wish to see again where my childhood passed, the place that the very first memories of my life had been through. On the other hand, I was afraid. Everything could have been changed. Maradit could took its credit from the destruction that we had done in everywhere for sake of urbanization. But it was not. Actually there was not much things changed. School, police station, square, they were standing where they were before. There were a few new buildings. After I parked my car at the square, I walked to the front of my school. I stand there for a while just to watch. When the things that I saw, reached my brain, memories in my mind refreshed again.

May, 1963, it was the last day of school. I was going to

school every day with my elder sister, at the end of the season, I was able to read and write. When the report card day arrived, as every children, I also was so excited. Everyone took their report cards, but me. Because I was six and I was not registered in school. Running and crying, I came home. Consolation of my mother could not stop my hiccups. Şerafet (Yazar) Teacher was our neighbor. She said "May report card was forgotten, and it will be given tomorrow, I remember I slept on her lap. Next day, when Şerife teacher brought my report card, I was so happy. But this situation, did not abolish obligation of going to first degree in new education year for me.

By passing police station, along with walkway, I walked up to our house. It was standing right there. I passed the wooden door, entered into garden. It had not surrendered to years, but it was tired, exhausted, its plasters peeled off, partly, bricks came off. It was quiet. There were not İskender Granddad, Ayşe Grandmamma. Its railing wooden lowered, I would have thought that it was left, if I did not see laundries that were hanged on balcony and hazelnuts that were down on the garden.

By passing among hazelnut gardens, I came down to shore of river. Coruh was again streaming murky. I sat down under a tree, and looked the opposite shore. There was not much change seemingly. Actually many things changed. The super state of my childhood which concurred the space, had fell apart, new states were established. Opposite shores was Georgia anymore.

I do not know whether Maradit (Murath) will stay like that in future? Or will human kind destroy here for sake of civilization? What is going to happen to our memories, our past? Our homes that we were born ad grown, school that we had education, streets where we played games, gardens. What will happen to our children that we keep alive in us with our memories? Will we able to sit by the shore of a dam lake, will we be able to see our past that gradually becoming dark under the bright lights? When we cannot see what is belong to us, what will happen to our sense of belonging that we feel for this land? While our past is sinking under the water, will our bright lights be able to enlighten our future? I do not know (Figure-6)⁽⁵⁾.

> Prof. Dr. Necdet Şükrü Altun March-2004. Ankara

(Note for reader: Maradit; is the old name of Murath town which in belong to Borçka district of Artvin. Çoruh River leaves our border after making a short border between

Turkey and Georgia.)

For sake of his father's duty, he completed his primary education in Artvin Gazi Primary School after he took every class in different places (Figure-7).



Figure-6. Muratlı Dem, it operates for two years from now on, and it was located close to town. The photo below, was taken in Karşıköy which is now under the Muratlı Dem water.

Figure-7. Primary School 3. Grade, April 23, National Sovereignty and Children's Day Ceremony. Doğruyol Township, Çıldır, Kars, 1965.

He completed Artvin Secondary School and Artvin Kazım Karabekir High School. In 1974, he moved to Ankara with his family. In 1975, he started his education in Ankara University Faculty of Medicine. It was also a beginning of new life for Prof. Dr. Necdet Altun. He moved to metropolis, the capital city, by leaving his relatives, friends and memories⁹.

Prof. Dr. Necdet Altun was a university student in a political and social turmoil period of country. At that period, universities divided into two parts as rightist and leftist. It was unlikely possible to be just a student by not involving one of this groups. As a young man who does not have friends and came from rural area, in the beginning, he had significant difficulties about keep following his education by not involving this groups, in the beginning. By the time, he get oriented that environment and made very good friendships (Figure-8).

Kamil İmamoğlu was one of his lecturers who affected him a lot, in faculty of medicine. He loved surgery thanks to him. Prof. Dr. Necdet Altun decided that "I should be a surgeon if I am going to be a doctor". Another one lecturer who guided him, was Rıdvan Ege, so to speak, Lecturer Rıdvan made a magical touch to his life. Rıdvan lecturer is the one who was the reason of being academician orthopaedist for Prof. Dr. Necdet Altun. With his own words "*He learned from him not* only orthopaedics but also how to be a good medical doctor and a good person". The statement of Rıdvan lecturer- "The one who has not benefit for others, is not a good human". - always became a guide for him⁹.



Figure-8. a) Ankara University Faculty of Medicine, first grade, chemistry laboratory. From the left Dr. Nihat Akçayöz-ENT, Dr. Levent Bozbeyoğlu –Orthopedics, Dr. Ünal Coşar-Radiology and Necdet Şükrü Altun, 1975. **b)** Exactly 40 years later, we renewed this photograph with same friends.

Prof. Dr. Necdet Altun graduated from Faculty of Medicine in July, 1981. For one year, he worked in Social Insurance Institution (SSK) Ulus Hospital as practitioner. This was a period when he improved his general medicine knowledge and handicrafts.

At the same year, he married with Seher Altun that they met one year ago in English course and who is having her senior year education in Gazi University, Faculty of Vocational Education.

In October 1982, he started to work as research assistant in Gazi University Faculty of Medicine, Department of Orthopaedic Surgery and Traumatology. In 1982, head of department was Prof. Dr. Orhan Aslanoğlu. Prof. Dr. Orhan Aslanoğlu was a valuable lecturer who graduated from Galatasaray University, made his orthopaedics speciality with famous French Judets brothers, and established Osteopathic Hospital in Eğirdir. Other lecturers of him were Assoc. Prof. Dr. İnanç Ayaz and Assoc. Prof. Özcan Kaymak. One year later, Prof. Dr. Rıdvan Ege came to Gazi University with assignment and became Head of Department. In Wednesday councils that were done with the leadership of lecturer Rıdvan, highly valuable lecturers were attending as guest. Prof. Dr. Rıdvan Ege was asking opinions of everyone by beginning from the lowest junior research assistant. This councils were very important school for assistants. Prof. Altun said that he learned a lot of things in this councils for both occupational and human relations (Figure 9)⁹.



Figure-9. After a Wednesday Council, with my lecturers, and assistant friends, 1984.

His daughter Merve was born in April 1985.

Prof. Dr. Necdet Altun became specialist in May, 1987. In June, he started his military service. At that time, medical officer cadet school was within Armored Forces School in Etimesgut. He had education with tanker reserve officer students. After education, he serves as orthopedist in Girne Military Hospital.

In 1988 November, he started his mandatory service in Trabzon Yavuz Sultan Selim Osteopathic and Rehabilitation Hospital. Prof. Dr. Necdet Altun told me that head physician of hospital was Orthopedics and Traumatology Specialist Numan Gül at that time. Numan Gül was a well-loved physician in Trabzon. They worked together for one year. Unfortunately, he passed away in a traffic accident in his early ages. After years, one day when Prof. Dr. Necdet Altun was head of department, a young doctor came to his room. He introduced himself as Orkun Gül. Orkun Gül was awarded to start his duty in Gazi University Faculty of Medicine Hospital, Department of Orthopaedic Surgery and Traumatology where Prof. Dr. Necdet Altun was started to work as research assistant and became head of department. Prof. Dr. Necdet Altun said to him "do you know anyone name Numan Gül, you look alike him a lot", he received the answer "I am his son". This moment became a memory which he can never forget in his life. The son of man who he worked together many years ago, became his student⁹.

Prof. Dr. Necdet Altun opened his first clinic in Trabzon. In the beginning, he did not have such intent but after a pharmacy that he knew there, saying *"according to people who live here, doctors who do not have clinic, are not acceptable"*, he had to open his clinic. Prof. Dr. Necdet Altun became a well-known and demanded doctor in Trabzon in a very short time. In one year that he worked in Trabzon, he earned significant experience⁹.

In 1989 autumn, he turned back to capital city by assigning to Dr. Muhittin Ülker Emergency and Traumatology Hospital. His clinic chief was Op. Dr. Savaş Ağaoğlu at that time. He was together with his classmates; Dr. Raşit Cesur and Dr. Levent Bozbeyoğlu. It was the most enjoyable period of his occupational life.

One year later, he turned back to Gazi University Faculty of Medicine Hospital, Department of Orthopaedic Surgery and Traumatology as assistant professor. In his passing to academic staff, Ridvan Ege lecturer and our valuable lecturer İnanç Ayaz that we lost in his early ages, had big contribution.

He became assistant professor in 1994 and professor in 2000. For a period of time, he was Head of Department of Surgery Sciences and head physician of Gazi Hospital.

He went great guns both in Head of Department and Head of Department of Surgical Sciences an also in his Head Physician period. Prof. Dr. Necdet Altun who retired in 2014 March with his own will, is keep doing his occupation in private health sector from that date⁹.

HIS PHOTOGRAPHY ADVENTURE:

According to Prof. Dr. Necdet Altun to keep mental health and motive on occupation for a physician, dealing with some works other than medicine, is very useful and also it is a necessity. One of this ways is art. Prof. Dr. Necdet Altun's choice is photograph art.

Meeting with photography happened because of his occupational needs. There is no doubt that, documentation in medicine is very important. Especially in spinal surgery, obtaining roentgen and clinical images and archiving them, are required. And also presenting and sharing them in meetings and congresses, are essential. For them all, in time, we all get professional help and spend a lot of money just like Prof. Dr. Necdet Altun. Especially, slide technic which is old-fashioned now, is highly costly work. I would like to express this process with his own words⁹:

This issue actually will have a short history of screening and presentation technique. Words that will take place in slide, firstly, is being written on a white paper with typewriter. Than it will be taken to slide movie with photograph machine. If it is published as negative, ground will be black and words will be white. With the roentgen photographs that were put between them, presentation would have been prepared. This processes, were being done in Education Center with Radio and Film which belongs to Ministry of Public Education which is located right opposite of Gazi Hospital, and which was located on Konya road. There were photograph masters who work in photograph studio. Hüseyin Tanboğa who is one of them, had a great effort on me. Later on, by using a special chemical, the black ground was turned into blue. It was out of the ordinary, and my first presentations which I did with this way, had a great effect. When I saw this, I thought to prepare a completely colored presentation. I prepared a DKC presentation. Yet, computer monitors were black and white. I printed words from IBM printer as negative, it means white words on black grounds. Then, I painted this words with colored pens. After I cut words in strip shape, by scanning different journals, I adhered colored child photos by using as background. Then, Hüseyin Tanboğa took colored slides of this pictures. The result was perfect in conditions of that day, it was the first presentation with this way. After presentation, I took many praises not about the context of the subject but about my presentation technic, I had to buy this technic for a long time of period. It was high in terms of cost but occupational acquisitions was very significant. After this experience, I thought that I should do this work by my own. I needed a professional photograph machine.

By paying a very high price according to my salary, I bought a Nikon 4004S when I was in abroad for a course. I had to learn photograph technics. We established photograph club in faculty with students. We had training from very valuable photograph masters. I became a member of Photograph Art Institution that was established in Ankara. Here, again I had trainings from very valuable photograph artist of our country, I attended studio works. I made presentations in photograph exhibitions and different institutions and foundations.

Photograph is the only way to stop the time. Photograph means is sharing. No one takes photographs just for see by his/herself. Photographers want to share, human being who shares his/her effort and art, is a good person. That's why, photographers are good people. Photographer can see and show details that no one can see or be aware of, by framing life, environment, people and society in a different way from others, just like a microscope. This mean is actually seeing more, living more and enjoying more, this mean is being happy. As a physician who deal with spinal surgery, the meaning of photograph is staying away from the stress a little bit, staying by myself, seeing different places, and different people and knowing different lives. I need it to protect my mental health ⁶ (Figure-10)"

HIS CONTRIBUTION TO SPINAL SURGERY:

The most important thing that impressed him in his spinal surgery career is that many people who educated, guided and trained him, had medicine education in a faculty where spinal surgery is being practiced and its education is being given in Turkey.


Figure-10. Photography works for Prof. Dr. Necdet Altun; a) Fog, b) The distant village, c) Jades, d) Child

His lecturers Rıdvan Ege, Güngör Sami Çakırgül and Zeki Korkusuz are important persons both in Turkish orthopedics and spinal surgery. It means, basically he was educated in Ankara Medicine ecole.

In Gazi University where he did his speciality, there was not academic member who deals with spinal surgery. The very first orthopedics surgery was done by Prof. Dr. Zeki Korkusuz with the invitation of lecturer Rıdvan. His assistant was Prof. Dr. Tarık Yazar. In a fracture event, Harrington instrumentation was practiced⁹.

He entered his first orthopedics surgery in Eğirdir Osteopathic Hospital with late Op. Dr. Savaş Ağaoğlu. It was an anterior debridement and fusion intervention because of Mal de Pott. He assisted Savaş Ağaoğlu in many spinal attempt during his time in Eğirdir. With his own saying: "Dr. Ağaoğlu is one of the best surgeons that I knew. Later on, he became our clinic chief in Emergency and Traumatology Hospital. I learned a lot from him. I gratefully memorialize him"⁹.

When he started to work as assistant professor, late Prof. Dr. İnanç Ayaz, said to him to choose either spinal surgery or orthopaedics oncology, he never hesitate to choose spinal surgery. At that days, in fractures, internal fixators (Dick) method was trend practice. They practiced that to a few patients with Özcan Kaymak. But, Prof. Necdet Altun was thinking about deformity surgeries and he wanted to learn and practice Cotrel-Dubousset instrumentation. In this subject, Op. Dr. Ömer Çeliker who was working in SSK Dışkapı Hospital, was the one who had the most cases in our country at that time. He watched him in a presentation and being impressed a lot. But, Dr. Çeliker passed away too early. I memorialize him with thankfulness and mercy.

He had gave appointment to one of his patient with scoliosis for CD practicing, but he lived through a problem related to marketing of system in our country, and Prof. Dr. Necdet Altun could not be able to realize the operation. At that exact time, a friend of him who was marketing orthopaedics products, showed him brochures of a TSRH system which was similar to CD system and which was started to practice in America. To learn the practice, Prof. Dr. Necdet Altun and I, found a chance to go to Dallas, Texas Scottish Rite Hospital where the system was developed and practiced. We learned highly valuable information about either practicing of system, or evaluation of patients with spine problem, or clinical approaches, indications and treatment options from Clinic Chief Dr. John Herring. TSRH is a very important mile stone in the spinal surgery career of Prof. Dr. Necdet Altun. Later on, Herring and his team, came to our country with our invitation, they made conferences both in Gazi Ortopedics Days and Turkish Spine Congress⁹ (Figure-11)

After he came back, he found many chances to practice TSRH, and he published its results^{1-3,10}. Later on, he found a chance to meet with Dr. Marc Asher, the lecturer of ISOLA instrumentation, he went to Kansas city of United States of America to learn ISOLA system which is a modern version of Luque System⁹ (Figure-12).



He get education about practicing of system and deformity surgery approach from Marc Asher, the creator of system. After he came back from Kansas with an important experience, he practiced ISOLA instrumentation successfully for many patients. In the department, he educated young friends about this modern system⁹.

Prof. Dr. Necdet Altun who had an important experience about Posterior attempts, received an invitation from Werner Wicker Clinic which Zielke is its founder from German ecole, to have experience in anterior attempt-thanks to personal friendship of Lecturer Ridvan Ege with Zielke-. Werner Wicker clinic was an important center in spinal surgery and its team was maintaining ecole although Zielke retired. Prof. Dr. Necdet Altun saying that three spinal surgery were realizing in center⁹. According to him, Dr. Metz and his team, were working in a machine order: "Dr. Metz was one of the most talented surgeons that I knew. I saw there what can a surgeon do in spinal surgery, how extended limits they can have. Germany experience significantly affected my vision about spinal surgery. I can say that, it aged me and raised my self-confidence and encouraged me as a surgeon."

He always was proud of having mission in some subjects and organizations about spinal surgery. As I mentioned in introduction, for a period of time, he was a board member of Turkish Spinal Association. In that period, he published his book "Degenerative Spinal Diseases" that he was editor

with Tarık Yazar. We, together, were assistant of Prof. Dr. Emin Alıcı who was founder and editor of The Journal Of Turkish Spinal Surgery-JTSS which was media organ of our association for a long time. He performed co-chairman duty of X. International Turkish Spine Congress in Nevşehir. Even though Brain Surgeons protested congress at that time, he realized congress successfully with the highest attendance and highest scientific context. Prof. Dr. Necdet Altun knew separation of scientific activities from personal interest as he always do, he demonstrated importance of be principled on the way of looking true but also be decent to all Turkish Spine family⁹.

Since 2005, he is performing spinal surgery with Prof. Dr. Ali Şehirlioğlu who is one the most important names that Turkish Spinal Surgery raised. With the team that was created by attendance of, in the beginning Prof. Dr. Serdar Kahraman after him, Assoc. Prof. Dr. Halil İbrahim Secer from brain surgery, two orthopaedist and two physiotherapist, he is keep working on spinal surgery. Last a few months before, he started directorate of LÖSANTE Hospital that The Foundation for Children with Leukemia established in Ankara. Prof. Dr. Necdet Altun who always saves his calmness, adopted modesty and honesty as principle, my elder brother who spreads his life energy, is not only one of the frontiers of Turkish Spinal Surgery but also one of the main posts. I wish healthy and many successful years for him.



Figure-13. Prof. Necdet Altun, with his students.

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- 1- Which sentence of the below is true according to the study of Özdoğan et al.
 - a) None of the variables were found to be significantly different between genders.
 - b) Mean age of male was 37,03 ± 11,52 years old and female was 37,55 ± 11,53 years old, respectively.
 - c) CT scan was used in the analysis
 - d) 20 female patients were included in this study
 - e) None of above
- 2- How many patients with the kyphosis had been evaluated in the study of Özdoğan et al?
 - **a)** 102
 - **b)** 202
 - **c)** 302
 - **d)** 402
 - **e)** 502
- 3- Which sentence of the below is true according to the study of Bilgiç et al?
 - a) This retrospective study comprised 20 female patients
 - **b)** The mean age of the patients was 56.4 years.
 - c) The mean follow-up period was 44.3 months.
 - d) Three segment fusion was applied to 22 patients
 - e) This study has demonstrated that two-level posterior instrumentation and fusion with local bone grafts and demineralized bone matrix have significantly better clinical and radiological results than single-level surgery.

4- How many patient was evaluated in the study of Bilgiç

- et al?
- **a)** 37
- **b)** 47
- **c)** 57
- **d)** 67
- **e)** 77

5- Which percentages below was true for the rate of the kyphoplasty according to the second study of Özdoğan *et al*?

CME QUESTIONS / STE SORULARI

- **a)** 11.8 %
- **b)** 21.8 %
- **c)** 31.8 %
- **d)** 41.8 %
- **e)** 51.8 %
- 6- Which percentages below was true for the rate of the fractures in the thoracolumbar region according to the second study of Özdoğan *et al*?
 - a) 15.5 %
 - **b)** 25.5 %
 - **c)** 35.5 %
 - **d)** 45.5 %
 - e) 55.5 %

7- How many cases operated were established according to the study of Özdoğan *et al*?

- **a)** 23.7 %
- **b)** 33.7 %
- **c)** 43.7 %
- **d)** 53.7 %
- **e)** 63.7 %
- 8- Which percentages below was true for the rate of the malposition of the screws according to the second study of Polat *et al*?
 - **a)** 13.6 %
 - **b)** 23.6 %
 - **c)** 33.6 %
 - **d)** 43.6 %
 - **e)** 53.6 %

9-	How many cases operated with the malposition of the screws have neural deficit according to the study of	JTSS 27(2) issue CORRECT ANSWERS OF CME QUESTIONS:
	Polat et al?	
	a) 4	1. e
	b) 5	2. c
		3. d
		4. b
	d) /	5 b
	e) None	6 0
		0. e
		7. a
10-	How many messages has been evaluated in the study of	8. d
	Aydoğmuş et al ?	9. d
	a) 1260	10. d

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b) 2260
c) 3260
d) 4260
e) 5260