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TÜRK OMURGA CERRAHİSİ DERGİSİ

Türk Omurga Cerrahisi Dergisi, Türk Omurga Cerrahisi Derneği'nin resmi yayın organıdır. Türk Omurga Cerrahisi Derneği, Prof. Dr. Emin Alıcı önderliğinde az sayıda üye tarafından 1989 yılında İzmir (Türkiye)'de kuruldu.

Derneğin kuruluş amacı:

- Omurga cerrahisi ile uğraşan Ortopedi ve Travmatoloji uzmanları ile Nöroşirurji uzmanlarını bir araya getirerek omurga cerrahisi ile ilgili bilgi ve birikimlerini paylaşmalarını sağlamak,

- Omurga cerrahisi konusunda çalışan hekimlerin sayılarını artırmak ve ülkemizde gelişmiş bir tıp disiplini haline getirmek,

- Omurga cerrahisi konusundaki gelişmeleri takip etmek ve üyelerine aktarmak,

- Uluslararası ve ulusal kongre, sempozyum ve kurslar düzenleyerek, omurga cerrahisi eğitimi vermek,

- Omurga cerrahisi eğitiminde standardizasyonu sağlamak,

- Omurga cerrahisi konusundaki bilimsel çalışmaları

özendirmek ve bu konudaki çalışmaları içeren dergi ve kitaplar çıkarmak,

- Tüm bu çabalarla Türk omurga cerrahisini geliştirmek ve Dünya omurga cerrahisine bu yolla katkılar sağlamaktır.

Türk Omurga Cerrahisi Dergisi, Türk Omurga Derneği'nin resmi yayın organıdır. Derginin amacı, Türk omurga cerrahlarının çalışmalarını ve literatürdeki yeni gelişmeleri yayınlayarak tüm Türk tıp camiasının ve özellikle omurga cerrahisiyle uğraşanların bilgi ve görgüsünü artırmaktır. Ayrıca dergi, dernek üyeleri hakkındaki gelişmeleri, omurga cerrahisi ile ilgili bilimsel kongre ve toplantıları, yeni çıkan yayın ve kitapları dergi abonelerine duyurmak amacını gütmektedir.

Türk Omurga Cerrahisi Dergisi'nin geçmişi, Türk Omurga Cerrahisi Derneği geçmişi kadar eskidir.

Derneğin ilk kez İzmir Çeşme' de düzenlediği kongre ile eş zamanlı olarak ilk 4 sayı yayınlanmıştır. İki yılda bir düzenlenen uluslararası kongrelerde sunulan çalışmalar, derneğin özendirmesiyle yazarları tarafından orijinal makale haline getirilmiş ve dergide yayınlanmıştır.

Dergi, klinik ve temel araştırma, davetli derlemeler ve olgu sunumları şeklindeki Yayın Kurulunun onayladığı orijinal makaleleri İngilizce veya Türkçe olarak yayınlar. Çalışmalar, en az iki hakem tarafından değerlendirildikten sonra yayınlanabilir. Yayın Kurulu, yayını kabul etme, düzeltilmesini isteme ve yayınlamama hakkına sahiptir. Dergi, her üç ayda bir çıkar ve dört sayıda bir cilt tamamlanır.

Türk Omurga Cerrahisi Dergisi'nde yayınlanan çalışmalardaki bilimsel veri, bilgi ve çıkarımlar ile ilgili bilimsel etik ve mediko-legal sorunlar yazının yazarlarının sorumluluğundadır, konuyla ilgili editörün ve yayın kurulunun hiçbir sorumluluğu yoktur.

Son yıllarda artan bilimsel etik ve mediko-legal sorumluluk bilinci dergimiz için temel esasları oluşturur.

Bilimsel çevrelerin ve toplumun da beklentisi bu yöndedir. Dergimizde yayınlanan makalelerde, alıntıların mutlaka kaynak belirtilerek kullanılması zorunluluğu vardır. Dergimiz, hasta haklarına saygılı olup, dergide yayınlanan çalışmalarda hasta onay formlarının olmasına özen gösterir ve hastaların kimliklerini deşifre edecek şekilde isimlerinin kullanılmasına, fotoğrafların göz bandı olmaksızın basılmasına izin vermez. Çalışmalara ait etik kurul onaylarının olmasını zorunlu tutar. Yazarlar, ticari kuruluşlardan maddi destek almışlarsa bu durumun açıkça belirtilmesini şart koşar. Dergimiz yazarlardan destek alınan kuruluşun makalenin içeriğine karışmadığına, yayınlanmasına müdahale etmeyeceğine ve izinsiz başka bir yerde kısmen veya tamamen yayınlanmayacağına dair taahhüt ister.

Türk Omurga Cerrahisi Dergisi, dernek üyelerine ve abonelere ücretsiz olarak dağıtılmaktadır.

Derginin yayın ve dağıtım giderleri, dernek üye aidatlarından, kongre gelirlerinden ve dergiye alınan reklâm bedellerinden sağlamaktadır. Reklâm bedelleri aktüel fiyatlara göre belirlenir. Dergi ya-

yın kurulu, bir veya birden çok ticari kuruluşla sponsorluk anlaşması yapmaya yetkilidir. Ancak ilgili kuruluşlar, asla derginin bilimsel içeriğine, tasarımına, yayınların yayınlanma sırasına ve sürecine müdahale edemezler.

Türk Omurga Cerrahisi Dergisi, Birleşmiş Milletler, "Global Compact" sözleşmesine uyacağını taahhüt etmiş ve bunu bir bildiri ile Birleşmiş Milletlere bildirmiştir. Bu meyanda, dergimiz genelde insan haklarına, özelde hasta haklarına ve deneysel çalışmalarda hayvan haklarına saygılı olunması gerektiği inancında olup, yayınlanan çalışmalarda bu prensiplere uyma zorunluluğu getirmiştir.

Son yıllarda klinik olarak ilgili bilimsel gelişmeler, çağdaş ölçüler, daha sofistike istatistiksel yaklaşımlar ve iyi formüle edilmiş araştırma planlarının artan kullanımını ve üst düzey raporlamayı içermektedir. Bilimsel yazılar, diğer yazılar gibi, yaratıcı bir süreci yansıtır, sadece bir eylemi değil. Bir raporun kalitesi tasarıdaki fikrin ve araştırmanın yönetilmesinin kalitesine bağlıdır. İyi hazırlanmış sorular veya hipotezler, tasarı ile ilişkilidir. İyi hazırlanmış hipotezler tasarıyı gösterir ve tasarı da hipotezi gösterir. Bir raporun etkililiği kısalık ve odak ile ilgilidir. Az noktaya dikkat çekmek yazarların kritik konulara odaklanmasını sağlar. Kısalık ve özlük tekrardan kaçınma (birkaç istisna hariç), sade stil ve düzgün gramer ile elde edilir. Pek az orijinal makalenin 3000 kelimeden fazla olmaya ihtiyacı vardır. Daha uzun makaleler temel yeni metotlar raporlanıyorsa veya bir literatür araştırması yansıtıyorsa kabul edilebilir. Yazarların ağdalı ifadeden kaçınması gerekmesine rağmen, etkili iletişim sağlayan kritik bilgi çoğu kez soruların (veya hipotezler veya anahtar konular) tekrarlanması anlamına gelir. Sorular Özet, Giriş ve Tartışma bölümlerinde belirtilmeli, ve yanıtlar Özet, Sonuçlar ve Tartışma bölümlerinde yer almalıdır.

Pek çok derginin makaleleri formatlamak için yönergeler yayınlamasına rağmen, yazı stilleri yazarların az veya çok kurulu ve alışkanlık edindikleri bir yazma stiline sahip oldukları için çeşitlidir.

Türk Omurga Cerrahisi Dergisi, geleneksel olarak genel yönerge olarak AMA stilini kullanmaktadır. Ancak pek az bilimsel ve tıbbi yazarın bu stilleri öğrenmek için zamanı vardır. Bu nedenle dergimiz düzgün dilbilgisi ve sade etkili iletişim sınırları içinde bireysel stillere hoşgörü ile yaklaşmaktadır.

THE TURKISH JOURNAL OF SPINAL SURGERY

The Turkish Journal of Spinal Surgery is the official publication of the Turkish Spinal Surgery Society. The Turkish Spinal Surgery Society was established in 1989 in Izmir (Turkey) by the pioneering efforts of Prof. Dr. Emin Alıcı and other a few members. The objectives of the society were to:

- establish a platform for exchange of information/ experience between Orthopedics and Traumatology Specialists and Neurosurgeons who deal with spinal surgery

- increase the number of physicians involved in spinal surgery and to establish spinal surgery as a sophisticated medical discipline in Turkey

- follow the advances in the field of spinal surgery and to communicate this information to members

- organise international and national congresses, symposia and workshops to improve education in the field

- establish standardization in training on spinal surgery

- encourage scientific research on spinal surgery and publish journals and books on this field

- improve the standards of spinal surgery nationally, and therefore make contributions to spinal surgery internationally.

The Turkish Journal of Spinal Surgery is the official publication of the Turkish Spinal Surgery Society. The main objective of the Journal is to improve the level of knowledge and experience

among Turkish medical society in general and among those involved with spinal surgery in particular. Also, the Journal aims at communicating the advances in the field, scientific congresses and meetings, new journals and books to its subscribers. The Turkish Journal of Spinal Surgery is as old as the Turkish Spinal Surgery Society. The first congress organized by the Society took place in Çeşme, Izmir, coincident with the publication of the first four issues. Authors were encouraged by the

Society to prepare original articles from the studies presented in international congresses organized by the Society every two years, and these articles were published in the Journal.

The Journal publishes clinical or basic research, invited reviews, and case presentations in English or Turkish after approval by the Editorial Board. Articles are published after they are reviewed by at least two reviewers. Editorial Board has the right to accept, to ask for revision, or to refuse manuscripts. The Journal is issued every three months, and one volume is completed with every four issue. Responsibility for the problems associated with research ethics or medico-legal issues regarding the content, information and conclusions of the articles lies with the authors, and the editor or the editorial board bears no responsibility.

In line with the increasing expectations of scientific communities and the society, improved awareness about research ethics and medico-legal responsibilities forms the basis of our publication policy.

Citations must always be referenced in articles published in our journal. Our journal fully respects to the patient rights, and therefore care is exercised in completion of patient consent forms; no information about the identity of the patient is disclosed; and photographs are published with eyebands. Ethics committee approval is a prerequisite. Any financial support must clearly be disclosed. Also, our Journal requests from the authors that sponsors do not interfere in the evaluation, selection, or editing of individual articles, and that part or whole of the article cannot be published elsewhere without written permission.

The Turkish Journal of Spinal Surgery is available to the members of the society and subscribers free of charge. The publication and distribution costs are met by membership fees, congresses, and the advertisements appearing in the journal. The advertisement fees are based on actual pricing.

The Editorial Board has the right for signing contracts with one or more financial organizations for sponsorship. However, sponsors cannot interfere in the scientific content and design of the journal,

and in selection, publication order, or editing of individual articles.

The Turkish Journal of Spinal Surgery agrees to comply with the "Global Compact" initiative of the UN, and this has been notified to the UN. Therefore, our journal has a full respect to human rights in general, and patient rights in particular, in addition to animal rights in experiments; and these principles are an integral part of our publication policy.

Recent advances in clinical research necessitate more sophisticated statistical methods, welldesigned research plans, and more refined reporting. Scientific articles, as in other types of articles, represent not only an accomplishment, but also a creative process. The quality of a report depends on the quality of the design and management of the research.

Well-designed questions or hypotheses are associated with the design. Well-designed hypotheses reflect the design, and the design reflects the hypothesis. Two factors that determine the efficiency of a report are focus and shortness. Drawing the attention to limited number of subjects allows the author to focus on critical issues. Avoidance from repetitions (apart from a few exceptions), a simple language, and correct grammar are a key to preparing a concise text. Only few articles need to exceed 3000 words, and longer articles may be accepted when new methods are being reported or literature is being reviewed. Although authors should avoid complexity, the critical information for effective communication usually means the repetition of questions (or hypotheses or key subjects). Questions must be stated in Summary, Introduction and Discussion sections, and the answers should be mentioned in Summary, Results, and Discussion sections.

Although many journals issue written instructions for the formatting of articles, the style of the authors shows some variance, mainly due to their writing habits. The Turkish Journal of Spinal Surgery adopts the AMA style as a general instruction for formatting. However, not many authors have adequate time for learning this style. Thus, our journal is tolerant to personal style within the limitations of correct grammar and plain and efficient communication.

YAZARLARA BİLGİLER

Türk Omurga Cerrahisi Dergisi (www.jtss.org),

Omurga Cerrahisi Derneği'nin yayın organıdır. Omurga hastalıkları ile ilgilenen hekim grubuna doğrudan hitap eden multidisipliner, hakemli bir dergidir ve spinal bilginin gelişimine önemli katkıda bulunacak orijinal çalışmaların yayınlanması amacıyla düzenlenmiştir. Dergi, klinik ve temel araştırma, davetli derlemeler ve olgu sunumları şeklindeki Yayın Kurulunun onayladığı orijinal makaleleri İngilizce veya Türkçe olarak yayınlar. Çalışmalar, en az iki hakem tarafından değerlendirildikten sonra yayınlanabilir. Yayın Kurulu, yayını kabul etme, düzeltilmesini isteme ve yayınlamama hakkına sahiptir. Dergi, her üç ayda bir çıkar ve dört sayıda bir cilt tamamlanır.

- Türk omurga cerrahisi dergisi, yıl içinde 4 kez yayınlanır: Mart, Haziran, Eylül ve Aralık.

- Türk omurga cerrahisi dergisine İngilizce özet (Summary) ve İngilizce anahtar kelimeler (Key Words) bölümlerine sahip, "Omurga Cerrahisi" ile ilgili:

I- Orijinal klinik ve laboratuar araştırma yazıları,

II- Vaka takdimleri,

III- Derleme yazılar kabul edilir.

Dergiye ulaşan çalışmanın, başka bir yerde daha önce yayınlanmamış (özet veya ön rapor dışında) veya yayın için değerlendirme aşamasında olmaması gerekir. Yayında adı geçen her çalışmacının, çalışmaya katılmış olduğu düşünülür. Tüm yazarlar, çalışmayı okuduklarını ve içeriği ile Türk Omurga Cerrahisi Dergisi'ne gönderilmesini onayladıklarını ekteki "Başvuru Mektubu"nda olduğu gibi ayrı bir yazı ile bildirmelidirler. Çalışmanın doğruluğu ile ilgili son sorumluluk, dergi, editörler veya yayıncıya değil, yazarlara aittir. Başvuru mektubunda ayrıca herhangi bir ticari kuruluştan destek alıp almadıklarını da açıkça belirmelidirler.

Hastanın isminin ve bilgilerinin saklanması esastır. Hastanın kimliğinin dikkatli bir şekilde korunacağının garanti edilmesi ve çalışmada insanlar üzerinde yapıldığı belirtilen herhangi bir deneysel çalışmanın, hasta bilgilendirilerek ve insan denekler üzerinde yapılan deneysel araştırmalarda öngörülen ve tüm yazarların görüş birliğine vardığı yasalar çerçevesinde uygulanması, yazarların sorumluluğudur.

Hastalardan yazılı izin alınıp ve bu belge çalışmayla birlikte dergiye yollanmadıkça hastaların tanınmaması için gözleri kapatılmalı ve fotoğraflardan isimleri çıkartmalıdır.

- İzinler: Yazarlar, ekte yer alan örnekteki gibi (Yayın Hakkı Devri Mektubu) ayrı bir yazı halinde, çalışmanın daha önce başka bir dergide yayınlanmadığını ve değerlendirmede olmadığını bildirmeleri gerekir. Yazarlar aynı zamanda çalışmalarının tüm yayın haklarını dergimize devrettiklerini bu yazı ile bildirmelidirler. Yazarların, başka bir yerde yayınlanmış olan alıntı, tablo ve resimlerin kullanılabilmesi için telif hakkı sahibinden (genellikle yayıncı) yazılı izin almaları ve göndermeleri gerekir.

Derlemelerin formatı, orijinal verileri bildirenlerinkinden farklı olacaktır. Fakat ortak prensiplerin çoğu uygulanır. Bir İncelemenin bir "Özet", bir "Giriş" ve bir "Tartışma" bölümüne ihtiyacı vardır. Giriş bölümünün odaklanmış konulara ve bu konular için bir gerekçeye ihtiyacı vardır. Yazarlar çalışmalarını diğer mevcut materyalden (monografi, kitap bölümleri) ayırtan benzersiz yaklaşımları okuyucuya sunmalıdır. Konular "Giriş" bölümünün son paragrafında verilmelidir. Bir incelemenin "Giriş" bölümü, orijinal materyali veren belgelere dayanan bir makale ile birlikte dört paragraftan uzun olması gerekmez. Daha uzun "Giriş" ler odağı kaybetmeye yatkındır, bu nedenle okuyucu hangi yeni bilginin sunulacağından emin olamaz.

"Giriş"ten sonraki bölümler nerdeyse her zaman belirli incelemeye özgüdür, fakat tutarlı bir şekilde düzenlenmelidir. Başlıklar (ve uygunsa alt başlıklar) paralel yapı izlemeli ve benzer konular yansıtmalıdır (örneğin tanısal kategoriler, metot seçimi, cerrahi müdahale seçimi gibi). Okuyucu sadece başlıkları göz önüne aldığında, incelemenin mantığını anlayacak şekilde açık olmalıdır. "Tartışma", gözden geçirilmiş literatürle uyumlu bir bütün olarak ve "Giriş"te belirtilen yeni konuların kapsamında birleştirir. Sınırlamalar, verilmiş bir çalışmadakinden ziyade literatürdekileri yansıtmalıdır. Bu sınırlamalar, teşhisin veya tedavi seçiminin az veya çok belirli değerlendirilmesine engel olan literatürdeki boşluklarla ilgili olacaktır. Literatürdeki çelişmeler kısaca araştırılmalıdır. Okuyucu sadece sınırlamaları araştırarak literatürü perspektife oturtur. Yazarlar "Tartışma" bölümünü, "Özet" bölümünün sonunda kısa haliyle verilecek olmasına benzer şekilde özet ifadeler ile bitirmelidir.

Genel olarak bir inceleme, konuya göre değişiklik göstermekle birlikte, belgelere dayalı bir makale ile karşılaştırıldığında daha geniş bir literatür incelemesine ihtiyaç duyar. Bazı konulara tüm bir monografide bile, (örneğin osteoporoz) kapsamlı şekilde atıfta bulunulamaz. Bununla beraber yazarların bir incelemenin tüm literatürü temsil ettiğini, ve bunun büyük olması durumunda çok sayıda referansa ihtiyaç duyulduğu unutulmamalıdır.

- Orjinal makaleler: "Başlık sayfası", "Özet", "Anahtar Kelimeler", "Abstract", "Key Words", "Giriş", "Materyal-Metot", "Sonuçlar", "Tartışma", "Çıkarımlar" "Kaynaklar" bölümlerini içermelidir. İngilizce olan orijinal makalelere Türkçe "Özet" ve Türkçe "Anahtar Kelimeler" bölümü eklenmelidir.

- Başlık (80 karakter, boşluklar dahil): Özet bölümünün okuyucunun dikkatini çekmesinde önemli olduğu gibi, başlık da aynı önemi taşımaktadır. Az sayıda kısa kelime ile soru ortaya atan veya soru cevaplayan başlıklar, sadece konuyu belirten başlıklardan daha başarılı olacaklardır. Ay-

rıca "Bisfosfonatlar kemik kaybını azaltır" gibi başlıklar ana mesajı etkili şekilde taşır ve okuyucuların daha çok aklında kalır.

- Başlık Sayfası: a) Çalışmanın açıklayıcı bir başlığını, b) Tüm yazarların tam isimleri ve akademik unvanlarını, c) Sorumlu yazarın adını, adresini, faks ve telefon numarasını, e-posta adresini, d) Sorumlu yazardan farklı ise "ayrı basımların" gönderilme adresini içermelidir. Başlık sayfası ayrıca hastalardan gerekli izinlerin alındığına ve etik kurul onayının olduğuna dair bilgiyi de içermelidir. Başlık sayfasında mutlaka "Kanıt Düzeyi" belirtilmelidir. Bunun için ekte yer alan Tablo-1'e bakılabilir. Ayrıca çalışmanın Tablo-2'de listesi yer alan konulardan hangisine girdiği (en fazla 3 konu) belirtilmelidir.

- Özet: İkinci sayfada, İngilizce yazılar için Türkçe, Türkçe yazılar için İngilizce, 150-250 sözcüklük bir özet yer almalıdır. Özet başlıca; geçmiş bilgiler, çalışmanın amacı, materyal-metot, sonuçlar ve çıkarımlar (Background Data, Purpose, Material- Methods, Results and Conclusion) bölümlerini içermelidir. İngilizce ve Türkçe özet birebir aynı olmalıdır.

Genel olarak bir Özet bölümü makalenin tamamı tamamlandıktan sonra yazılmalıdır. Bunun sebebi, yazma sürecinin düşünceyi ve hatta belki de amacı nasıl değiştirdiği ile ilişkilidir. Yazar(lar) ancak verilerin dikkatli gözden geçirilmesi ve literatür ile sentezinden sonra etkili bir özet yazabilir.

Günümüzde pek çok okuyucu basılı materyallerde aramaktansa, internet bazlı veritabanları aracılığıyla tıbbi ve bilimsel bilgiye erişiyor. Erişimin dışında okuyucunun girişi başlıklar ve özetlerden geçtiği için sağlam başlıklar ve özetler okuyucun dikkatini daha etkili şekilde çeker. Bir okuyucunun tüm makaleyi inceleyip incelemeyeceği çoğunlukla zorlayıcı bilgi içeren bir özete bağlıdır. Zorlayıcı bir Özet soruları veya amaçları, metotları, sonuçları (çoğunlukla nicel veriler) ve neticeleri içerir. Bunların her biri bir veya iki ifadeyle verilebilir. "Bu raporun açıkladığı konu …" gibi ifadeler çok az faydalı bilgi verir.

- Anahtar Kelimeler : Bilimsel indekslerde ve arama motorlarında standart kullanılan kelimeler seçilmelidir. Anahtar kelime sayısı en az 3 en fazla 5 adet olmalıdır.

- Giriş (250 – 750 kelime): Makale konusuyla ilgili tarihsel literatür bilgisini içermeli, problem ortaya konulmalı, çalışmanın amacı ve problemin çözümü için yapılanlar anlatılmalıdır.

Giriş kısmı en kısa bölüm olduğu halde belki de en kritik bölümdür. Giriş bölümü konuları etkili bir biçimde belirtmeli, bu konular ve sorular için gerekçeleri formüle etmelidir. Bununla beraber çalışmaların çoğu şunlar için yayınlanır: (1) tamamen yeni buluşları bildirmek için (nadiren vaka raporlar, fakat bazen temel veya klinik çalışmalar); (2) daha önceden raporlanan çalışmaları teyit etmek için (örneğin vaka raporları, küçük ilk seriler); (3) veriler ve/veya sonuçlar çelişkili ise literatürdeki çelişkileri takdim etmek veya belirtmek için. Araştırmalar ve diğer özel makalelerin dışında bu üç amaçtan bir tanesi genelde Giriş bölümünde belirtilmelidir.

İlk paragraf genel konuyu veya problemi sunmalı ve önemini belirtmelidir, ikinci ve belki üçüncü bir paragraf gerekçeleri sunmalı, ve bir son paragraf soruları, hipotezleri ve amaçları belirtmelidir. Bazıları gerekçeleri ve hipotezleri formüle etmeyi Aristo mantığı (tasımsal model) olarak düşünebilir ve şu formu ele alabilir: A, B ve C ise, D, E ve F'dir. A, B ve C öncülleri kabul edilmiş olguları yansıtırken, D, E veya F mantıklı çıkarımlar veya tahminleri yansıtır. Öncüller en iyi yayınlanmış yayınlardan çıkar, fakat mevcut veri yoksa yayınlanmış gözlemler (tipik niteleyici), mantıklı iddialar veya fikir birliği kullanılabilir. Bu öncüllerin gücü aşağı yukarı veriler ile gözlemlerin azalan sırasında veya fikre karşı olan iddiadır. D, E veya F mantıklı sonuçları yansıtır. Gözlem sıralarını açıklamalar (D, E veya F) mantıklı şekilde takip eder. Bu nedenle hipotezleri formüle ederken, deneyleri tasarlayan ve sonuçları raporlayan araştırmacılar tek bir açıklamaya bağlı kalmamalıdır.

Gerçekten yeni materyallerin olduğu ender istisnalarla birlikte, yazarlar gerekçeler öne sürerken temsili literatüre referans vermelidir. Bu gerekçeler yenilik ve soruların geçerliliğini kurar ve literatüre yerleştirir. Yazarlar öncülleri ilgili aktarmalar ile sade bir şekilde belirtmeli ve alıntılar ile yazarlarının isimlerini tanımlamaktan kaçınmalıdır. Bu yaklaşımdaki istisnalar yeni bir metot için gerekçe geliştirmekte gerekli olduğunda geçmiş metotların tanımını, veya geçmiş örnek oluştururken önemli olduğunda yazarların isimlerine ithafı içerir. Alıntıların açıklamaları uygun görülürse Tartışma bölümünde takip edebilir. Bir gerekçe hazırlarken, her türlü yeni müdahale belli sorunları çözmek içindir. Örneğin, yeni implantlar (konsept olarak yeni değilse) daha önceki implantlar ile yaşanan sorunları bertaraf etmek için belirli kriterlere göre tasarlanır. Amaç yeni bir tedavinin raporlanması ise çalışmanın öncülleri, açıklanan sorunları (mümkünse nicel sıklıklarla) içermelidir ve onlara atıfta bulunmalıdır.

Son paragrafta mantıklı olarak öncekilerden başlar ve çalışmanın değişkenlerine (bağımlı, bağımsız) göre belirtilecek sorular veya hipotezleri açıklamalıdır. Çalışma değişkenlerine göre dayandırılmayan konular anlamlı şekilde belirtilemez. Raporun odağı bu sorulara odaklanmayla ilgilidir ve rapor literatürde iyi şekilde açıklanmış cevapları olan sorulardan kaçınmalıdır (örneğin idiopatik skolyozda en fazla rotasyon olan omur apikal omur mudur?). Sadece yeni ve açıklanmamış bilgi varsa veriler, belirtilmiş soruları cevaplama gereği dışında bildirilmelidir.

- Materyal-Metot (1000-1500 kelime): Hastaların epidemiyolojik, demografik bilgileri, klinik ve radyolojik çalışmaları, cerrahi teknik, sonuçların değerlendirme metodu ve istatistik çalışmalar bu bölümde ayrıntılı olarak belirtilmelidir.

Prensip olarak "Materyal ve Metot"lar çalışmayı tekrarlamak için başka araştırmacı için yeterli detayları içermelidir. Uygulamada ise, bu tür detaylar ne pratiktir ne de istenir çünkü pek çok metot daha önce daha detaylı olarak yayınlanmıştır ve ayrıca uzun tanımlar okumayı zorlaştırır. Bununla beraber, Materyaller ve Metotlar bölümü tipik olarak en uzun bölümdür.

Klinik çalışmaları raporlarken yazarların ülkelerinin kanunlarına ve düzenlemelerine göre etik komitelerinin veya kurumsal inceleme kurulunun onayını belirtmek zorundadırlar. Uygun yerde bilgisi verilen onay belirtilmelidir. Bu onay "Materyal ve Metot" bölümünün ilk paragrafında belirtilmelidir.

Başlangıçta okur temel çalışma tasarısını görmelidir. Yazarlar daha önce raporlanmış metotları sadece kısa bir şekilde tarif etmeli ve atıfta bulunmalıdır. Yazarlar bu metotları değiştirdiğinde bu değişiklikler ilave açıklama gerektirir. Klinik çalışmalarda hasta sayısı ve demografisi başta belirtilmelidir. Klinik çalışmalar dahil olan ve hariç olan kriterleri, serilerin ardıl mı veya seçilmiş mi olduğunu; seçilmişse seçimde rol oynayan kriterleri belirtmelidir. Okuyucu bu tanımdan yargının tüm potansiyel kaynaklarını, teşhisi, istisnayı, tekrarı veya tedavi fikrini anlamalıdır. Temel olarak gelecek çalışmalar için harcanan çaba ve masraf ile, çoğu yayınlanmış klinik çalışmanın geçmişe dayalı olması şaşırtıcı değildir. Bu tür çalışmalar çok kez geçmişe dayalı olduğu için haksız yere eleştirilir, fakat bu çalışmanın geçerliliğini ve değerini ortadan kaldıramaz. Dikkatli bir şekilde hazırlanmış geçmişe dayalı çalışmalar mevcut olan bilgilerin çoğunu sunar. Bununla beraber yazarlar takipte kayıp, zorluklar, eksik veri ve geçmişe dayalı çalışmalarda yaygın olan çeşitli fikir formları gibi potansiyel problemleri tanımlamalıdır.

Yazarlar istatistiksel analiz kullanırsa, Materyaller ve Metotlar bölümünün sonunda kullanılan tüm istatistiksel testleri belirten bir paragraf yer almalıdır. Birden fazla test kullanıldıysa yazarlar hangi testlerin hangi veri seti için kullanıldığını belirtmelidir. Tüm istatistiksel testler varsayımlar ile ilişkilidir, verilerin bu varsayımları karşılayacağı açıkça görülmezse yazarlar ya destekleyici verileri sunmalıdır yada alternatif testler kullanmalıdır. Önem seviyesi seçimi kanıtlanmalıdır. 0,05'lik alfa ve 0,80'lik beta seviyesi seçilmesi yaygın olmasına rağmen bu seviyeler bir şekilde isteğe bağlıdır ve her zaman uygun değildir. Bir hata çıkarımının ciddi olduğu durumda, klinik veya biyolojik önemi değerlendirmek için çalışma tasarısında farklı alfa ve beta seviyeleri seçilebilir.

- Sonuçlar (250-750 kelime): "Sonuçlar" mümkün olduğunca anlaşılır ve özet belirtilmeli, ayrıntılı sonuçlar tablolarda verilmelidir. Okuyucunun daha iyi anlayabilmesi için sonuçlar bölümü alt başlıklarla bölünebilir.

Sorular veya konulara "Giriş" bölümünde yeterli şekilde odaklanıldıysa, "Sonuçlar" bölümünün uzun olması gerekmez. Genelde okuyucuyu metotların geçerliliğine ikna etmek için bir veya iki paragrafa ihtiyaç duyulur, açıkçaortaya konan her soru veya hipotezi anlatan bir paragrafve son olarak yeni ve beklenmeyen bulguları raporlayan paragraflar. Her paragrafın ilk (konu) cümlesi konuyu belirtmeli veya soruyu yanıtlamalıdır. Okuyucu "Sonuçlar" bölümündeki her paragrafın sadece ilk cümlesini göz önüne aldığında, yazarın çıkarımlarının mantığı açık olmalıdır. Tüm rakam ve tablolara yapılan parantez içi ithaflar, yazarı verilerin yorumunu yazılı olarak yapmaya zorlar; önemli olan materyal veriler değil yazarın verileri yorumlamasıdır.

Verilerin istatistiksel raporlanması özel dikkat gerektirir. Bazı sonuçları vurgulamak için artar veya azalır (veya daha fazladır veya daha azdır) ifadeleri ile birlikte ve karşılaştırmalı kısımlardan hemen sonra p (veya başka istatistik) değerini parantez içinde belirtmek daha etkilidir. Buna ilave olarak, istatistiksel olarak farklı veya önemli ölçüde farklı olan koşullardan kaçınmak okuyucunun istatistiksel önemden bağımsız olarak istatistiksel değeri biyolojik veya klinik açıdan önemli olarak kabul edip etmeyeceklerine karar verme imkanı verir. Felsefe ve stil konusu olmasına rağmen, asıl p değeri, önceden konmuş seviyelerden daha düşük bir değer belirtmekten daha fazla bilgi taşır. Ayrıca Motulsky'nin dikkat çektiği üzere, "Bir sonucun çarpıcı olmadığını okuduysanız, düşünmeye devam edin … Önce, güven aralığına bakın … İkinci olarak eğer orada olsaydı bir çarpıcı farkı bulmak için çalışma nın gücünü sorgulayın." Bu yaklaşım okuyucuya biyolojik veya klinik etkililik konusunda daha iyi fikir verecektir.

- Tartışma (750-1250 kelime) : Tartışma bölümü spesifik unsurlar içermelidir: bunun için problem veya sorunun tekrar belirtilmesi, sınırlamalar ve varsayımların araştırılması, literatürdeki bilgiler ile bir karşılaştırma, karşılaştırmanın bir sentezi ile sonuca ulaşmak gereklidir. Problem veya sorunun yeniden belirtilmesinin vurgu amacıyla kısa olması gerekmektedir. Bunun sonrasında varsayımların ve sınırlamaların verilmelidir. Sınırlamaları araştırmadaki başarısızlık, yazarın bilmemesi veya göz ardı ettiğini seçmesini gösterir, bu da okuru yanlış yönlendirir. Bu sınırlamaları araştırma sadece kısa olmalıdır, fakat tüm eleştirel konular tartışılmalıdır ve okuyucunun sonuçları kafasında şüpheye düşürmemesi sağlanmalıdır.

Sonrasında yazarlar verilerini literatürde belirtilen veriler ile karşılaştırmalı ve/veya karşıtlıklarını bulmalıdır. Genel olarak bu raporların çoğu Giriş bölümünde bahsedilen ge-

rekçeleri içerecektir. Verilen bir çalışmanın özellikleri nedeniyle, veriler ve gözlemler literatürdekiler ile karşılaştırılabilir olmayabilir, en az eğilimleri içermemesi yaygın değildir. Nicel karşılaştırmalar, çalışmadaki verilerin yaklaşık değer olduğu konusunda okuyucuyu en etkili şekilde ikna eder, ve tablolar veya rakamlar bilgiyi etkili şekilde verir. Mümkün olduğunda çelişkiler belirtilmeli ve açıklanmalıdır; bir çelişkinin açıklaması açık olmadığı zaman bu da belirtilmelidir. Sadece makaledeki verilere dayalı olan sonuçlar nadiren kesindir çünkü literatür neredeyse her zaman önceki bilgileri içerir. Herhangi bir raporun kalitesi bu karşılaştırmaların bağımsız doğasına bağlı olacaktır. Son olarak, yazar(lar) verilerini literatürdekiler ile sentezlemelidir. Hiçbir eleştirel veri gözden kaçmamalıdır, çünkü karşıt veri bir görüşü etkili şekilde çürütebilir. Yani nihai sonuçlar sadece sundukları yeni veriler ile değil ayrıca literatürdekiler ile de uyumlu olmalıdır.

- Çıkarımlar : Çalışma sonucunda yazarların vardığı yargılar ve öneriler kısaca belirtilmelidir. Bu bölümde çalışmada elde edilen bilimsel verilere dayanmayan tahmin ve kişisel fikirleri içeren cümlelere yer verilmemelidir.

- Kaynaklar : Kaynakların bilimsel indekslerde bulunabilir olmasına dikkat edilmelidir. Kişisel görüşme bilgilerine kaynaklarda yer verilemez. **Kaynaklar alfabetik sıra ile dizilmeli ve yazı içinde mutlaka site edilmeli, site edilmeyen kaynaklar listede yer almamalıdır.** Sempozyum ve Kongre bildiri sunumlarının özetleri makale ile birlikte yollanmalıdır. Aşağıdaki listeleme yöntemi kullanılmalıdır.

Referanslar (ithaflar) öncelikle emsal taranmış dergiler, standart ders kitapları veya monografi, veya kabul görmüş ve sabit elektronik kaynaklardan elde edilmelidir. Yazarlar verilerin yorumuna bağlı alıntılar için genellikle sadece yüksek kalitede emsal taranmış kaynaklar kullanmalıdır. Özetler ve sunulan makaleler kullanılmamalıdır çünkü bu kategorilerdekilerin çoğu emsal taramadan geçirilmemiştir.

Gerek görülürse, yazarlardan herhangi bir kaynağın tam metni istenebilir. Veriler, yayınlanmamış bir kaynaktan alınmışsa, çalışmanın adı ve yeri gibi bilgiler verilmelidir. Gönderilen fakat henüz basım için kabul edilmemiş olan yazılar ve kişisel görüşmeler, metinde site edilmelidir. Dergi isimlerinin kısaltmaları için Index Medicus içeriğindeki "list of journals" bölümüne başvurulabilir veya http://www.nlm.nih.gov/tsd/serials/lji.html adresinden liste elde edilebilir. Kaynaklar, şu şekilde düzenlenmelidir:

Dergiden Makale:

1. Berk H, Akçalı Ö, Kıter E, Alıcı E. Does anterior spinal instrument rotation cause rethrolisthesis of the lower instrumented vertebra? J Turk Spinal Surg 1997; 8 (1):5-9.

Kitaptan Bölüm:

2. Wedge JH, Kirkaldy-Willis WH, Kinnard P. Lumbar spinal stenosis. Chapter 5. In: Disorders of the lumbar spine. Eds.: Helfet AJ, Grubel DM, JB Llippincott, Philadelphia 1978, pp: 61-68.

Kitap:

3. Paul LW, Juhl JH. The essentials of Roentgen interpretation. Second Edition. Harper and Row, New York 1965, pp: 294-311.

Kitap ve Cilt No:

4. Stauffer ES, Kaufer H, Kling THF. Fractures and dislocations of the spine. In: Fractures in adults. Vol 2. Eds.: Rockwood CA, Gren DP, JB Lippincott, Philadelphia1984, pp: 987-1092.

Yayında Olan Makale:

5. Arslantaş A, Durmaz R, Coşan E, Tel E. Aneurysmal bone cysts of the cervical spine. J Turk Spin Surg (In press).

Yayında Olan Kitap:

6. Condon RH. Modalities in the treatment of acute and chronic low back pain. Low back pain. Ed.: Finnison BE, JB Lippincott, Philadelphia (In press).

Sempozyum:

7. Raycroft IF, Curtis BH: Spinal curvature in myelomeningocele: Natural history and etiology. Proceedings of the American Academy of Orthopaedic Surgeons Symposium on Myelomeningocele, Hartford, Connecticut, November 1970. St. Louis, CV Mosby, 1972, pp : 186-201.

Toplantılarda Sunulan Bildiriler:

8. Rhoton AL: Microsurgery of the Arnold-Chiari malformation with and without hydromyelia in adults. Presented at the annual meeting of the American Association of Neurological Surgeons, Miami, Florida, April 7, 1975.

- Tablolar: "Tablolar", Arap rakamlarıyla metin içinde geçiş sıralarına göre numaralandırılmalıdır. Her bir tablo, ayrı bir sayfada verilerek tablo başlığı ve açıklamalı yazısı eklenmelidir. "Tablolar", yazının içine Sıkıştırılmamalı, çalışmanın tekrarından çok eki olmalıdır. "Tablolar"daki bilgiler yazıdan bağımsız incelense bile kolaylıkla fikir verecek nitelikte açık ve anlaşılır olmalıdır. "Tablolar"da verilen bilgiler yazı içinde tekrarlanmamalıdır. "Tablolar"da mümkünse istatistiksel ortalamalar, standart sapma, t ve p olasılık değerlerine yer verilmelidir. Tabloda yapılan kısaltmalar tablo altında açıklanmalıdır.

Rakamlar ve tablolar metinde materyali tekrar etmemeli, tamamlamalıdır. "Tablolar", yazılı şekilde tanımlaması zor olacak olan bilgiyi yoğun şekilde sunarlar. Metinde kısa ve öz olarak tarif edilen materyal tablo ve rakamlar ile anla-

tılmamalıdır. Örneğin klinik çalışmalar çoğu kez sonuçları yorumlamada önemli olmalarına rağmen makalede ortaya konan sorular için kritik olmayan demografik veriler için tamamlayıcı tablolar içerir. İyi odaklanmış çalışmalar "Giriş" bölümünde belirtilen her soru ve hipotez için sadece bir veya iki tablo veya rakamlar içerir. İlave materyaller beklenmeyen sonuçlar için kullanılabilir.

İyi yapılandırılmış "Tablolar", kendiliğinden açıklayıcıdır ve sadece bir başlığa ihtiyaç duyar. Her sütun birimlerle birlikte bir başlık içerir. Fakat rakamların sembollerin anlamlarını da içerecek şekilde bazı açıklamalara ihtiyacı olabilir. Gerekli veri açıklamalarına ek olarak rakam göstergeleri ortaya konan sorular çerçevesinde ana noktaları içermelidir; açıklamalar tam cümleler olarak yazılmalıdır. Okuyucu "Giriş" bölümünün son paragrafında soruları okuyabilmelidir, sonra "Sonuçlar" bölümünün her paragrafının ilk cümlesinde ve rakam açıklamalarında yanıtları bulabilmelidir.

- Resim ve Şekiller: Tüm figürler, metin içinde sırasıyla numaralandırılmalıdır. Her resim/şekil in arkasında, üzerinde numarasını, üst kenarını gösteren ok işaretini ve ilk yazarın adını içeren bir etiket bulunmalıdır. Siyah-beyaz baskılar, parlak kağıt üzerinde olmalıdır (9x13 cm). Resim/şekil üzerindeki yazının harf karakteri, figür küçülünce okunaklı olacak şekilde büyük olmalıdır. Profesyonel olmayan, daktilo karakterleri kabul edilmez. Resim/şekil açıklamaları, referanslardan sonra, ayrı bir kağıda yazılmalıdır. Dergi, yazının değerini arttıracak olan renkli baskıları da kabul eder. Ancak, bu baskılar, yazarlar ödeme yapmadan yayınlanamaz. Yazarlar, renkli baskılar için ödeme yapmazlarsa, siyah-beyaz basılmasını isteyebilirler. Elektronik yolla yollanan çalışmalar için resimler jpeg ve tiff formatında olmalı, 300 dpi üstünde rezolüsyona sahip olmalıdır. Resimler numaralandırılmalı, mutlaka yazı içinde site edilmelidir.

- Stil: Yazı şablonu, "American Medical Association Manual of Style (9th edition)" verilerine göre biçimlendirilir. Stedman's Medical Dictionary (27th edition) ve Merriam Webster's Collegiate Dictionary (10th edition), standart referanslar olarak kullanılmalıdır. İlaç ve terapötik ajanlar, kabul edilen jenerik ve kimyasal isimlerine göre yazılmalı ve kısaltma kullanılmamalıdır. Kod numaraları, ancak jenerik ismi bulunamıyorsa, kullanılmalıdır. Bu durumda, ilacın kimyasal yapısını veren kimyasal maddenin ismi ve şekli elde edilmelidir. ilaçların ticari isimleri, jenerik isminden sonra parantez içinde verilmelidir. Marka kanununa uymak için yazıda adı geçen her ilaç veya cihazın imalatçısının isim ve yeri belirtilmelidir. Ölçüm birimleri için metrik sistem, ısı ölçümü için Celsius kullanılmalıdır. Geleneksel birimlerden çok Standart birimlerin kullanılmasına dikkat edilmelidir.

Kısaltmalar, yazıda ilk kullanıldığı yerde, her tablo ve her figürde tanımlanmalıdır. Bir firma ismi bildirilecekse, imalatçının isim ve adresi (şehir ve ülke) verilmelidir.

Standart kısaltma listesi için, "Council of Biology Editors St yle Guide" (Council of Science Editors, 9650 Rockville Pike, Bethesda, MD 20814 adresinden ulaşılabilir) veya diğer standart kaynaklara başvurulabilir.

- Teşekkür : Mali olmayan tüm teşekkürleri bu bölümde belirtiniz. Şu cümleyle başlayabilirsiniz: "Yazarlar …'e teşekkür etmek ister". Teşekkür bölümünde, farmasötik endüstri dahil, tüm destekler bildirilmelidir.

- Pratik İpuçları :

1- Bu ifadelerin tüm kritik materyali içerip içermediğini ve mantıksal akışın açık olup olmadığını doğrulamak için metin içinde her paragrafın sadece ilk cümlesini okuyunuz.

2- "…bu raporun açıkladığı konu…" gibi Özet ifadelerden kaçınınız. Bu tür ifadeler okuyucu için temel bilgi vermez.

3- Özet bölümünde referans ve istatistiksel değerlerden kaçınınız.

4- Geçmişe dayalı örnek kurma haricinde alıntı yapılan yazarların isimlerini kullanmaktan kaçınınız. konuyu belirtiniz ve altyazıyla alıntı veriniz.

5- Giriş bölümünün son paragrafında "…verilerimizin raporunuz sunuyoruz…" gibi cümlelerden kaçınınız. Bu tür ifadeler okuyucunun (ve yazarın!) dikkatini kritik konulara odaklamasını engeller.

6- Tablo ve rakamlara parantez içinde atıfta bulunun ve tablonun bir cümlenin öznesi veya nesnesi olduğu ifadelerden kaçınınız. Parantez içindeki atıflar tablo ve rakamın değil, tablo ve rakamlardaki bilginin yorumunu vurgular.

7- Giriş bölümünden Tartışma bölümüne kadar düzenli olarak kelimeleri sayınız.

- En fazla sayıda revizyona neden olan konuları şunlardır:

1- Açık sorular ve cevaplar verilmemiştir. Hastaları dahil eden tüm metinler için Türk Spinal Cerrahi Dergisi, açık bir birincil araştırma sorusu gerektiren Delil Düzeyi yayınlar. Bu soru açık bir şekilde cevaplanmalıdır.

2- Başlık sayfasında bir Delil Düzeyi belirtiniz. Düzey ne kadar yüksek olursa o kadar iyi olur.

3- Hasta popülasyonları, okuyucunun çeşitli eğilim formlarını araştırması için yeterli şekilde tanımlanmamıştır.

4- Çalışma sınırlamaları Tartışma bölümünde bulunmamıştır.

5- Aktarılmamış veya eksik referanslar; uygun formatında olmayan referanslar.

6- Eksik telif hakkı transfer formları.

7- Daha önce yayınlanmış materyal için eksik izinler

(tablolar, şekiller)

Başvuru Mektubu Örneği:

Türk Omurga Cerrahisi Dergisi

Sayın Editör,

Ekte Türk Omurga Cerrahisi Dergisi'nde incelenmek üzere "……" başlıklı bir metin gönderiyoruz.

Adı geçen yazarlar çalışmayı tasarladılar (parantez içinde uygun yazarların isimlerini yazınız), verileri topladılar (parantez içinde uygun isimlerini baş harflerini yazınız), verileri analiz ettiler (parantez içinde uygun yazarların isimlerini yazınız), ilk taslakları yazdılar (parantez içinde uygun yazarların isimlerini yazınız) ve veri ile analizin tutarlılığını sağladılar (parantez içinde uygun yazarların baş isimlerini yazınız).

Tüm yazarların bu metnin içeriklerini ve son halini gördüğünü ve onayladığını ve çalışmanın başka bir yerde tamamen veya kısmen yayınlanmadığını kabul ettiklerini teyit ederim.

Bu yazışmayı sağlayan yazar olarak ben (ve diğer yazarlar) Türk Omurga Cerrahisi Dergisi'nin tüm yazarların çalışmanın herhangi bir kısmını destekleyen ticari kurum ile bir sözleşme veya anlaşma imzalamış olabileceğini belirtmesini istediğini anlıyoruz. Ayrıca bu bilginin, çalışma incelenirken gizli tutulacağını ve yazımsal kararı etkilemeyeceğini, fakat çalışma yayınlanmak üzere kabul edilirse çalışmada bir ifşaat açıklaması yer alacağını kabul ediyoruz. Aşağıdaki açıklamaları, benim ve diğer yazarların çalışmayla ilgili olarak ticari ilgisi olmadığını belirtmek amacıyla seçtik.

1) Tüm yazarlar çalışma için toplanmış tüm veya bir kısım verilerin yayımını sınırlayacak veya her hangi bir sebepten yayımı geciktirecek şekilde, bu çalışmayla ilgili olarak ticari bir anlaşma imzalamadığını beyan ederler.

2) Yazarlardan biri veya birkaçı (isimleri) bu çalışmayla ilgili ticari bir anlaşma imzaladığını, ancak bu anlaşmaların ticari kurumun verilere sahip olma veya kontrol etme ve gözden geçirme ve değiştirmesine müsaade etmeyeceğini ve yayımlanmasını geciktirmeyeceğini veya önleyemeyeceğini taahhüt ederiz.

3) Yazarlardan biri veya birkaçı (parantez içinde uygun yazarların isimlerini yazınız) bu çalışmayla ilgili ticari bir anlaşma imzaladığını ve bu anlaşmaların ticari kurumun verilere sahip olma veya kontrol etme ve gözden geçirme ve değiştirme hakkına sahip olduğunu bildiririz ve fakat yayımlanmasını geciktirmeyeceğini ve önleyeceğini taahhüt ederiz

Saygılarımla,

Yazışmadan sorumlu yazar

Yazarlık Sorumluluğu, Finanssal İfşa, ve Telif Hakkı Transferi

METİN BAŞLIĞI:

YAZIŞMAYI YÜRÜTEN YAZAR:

YAZIŞMA ADRESİ:

TELEFON / FAKS NUMARALARI:

Her yazar aşağıdaki açıklamayı okumalı ve imzalamalıdır; eğer gerekliyse bu belgeyi fotokopi ile çoğaltmalı ve orijinal imzaları için diğer yazarlara vermelidir. Doldurulmuş formlar yazı kuruluna gönderilmelidir:

SUNUM KOŞULLARI

SAKLI HAKLAR: Telif hakkının dışında, çalışmayla ilgili diğer özel haklar yazarlar tarafından elde tutulmalıdır.

ORJİNALİTE: Her yazar çalışmaya katkısının orijinal olduğunu ve bu anlaşmaya girmek için tam yetkisinin olduğunu garanti eder. Ne bu çalışma ne de benzer bir çalışma yayınlanmıştır. Ayrıca bu yayının değerlendirmesi altındayken başka bir yerde yayınlanmak üzere de gönderilmemiştir ve gönderilmeyecektir.

YAZAR SORUMLULUĞU: Her yazar, çalışmanın yayın sorumluluğunu almak üzere, düşünsel içeriğe, verilerin analizi ve çalışmanın yazılmasında yeterli ölçüde yer aldığını doğrular. Her biri çalışmanın son versiyonunu incelemiştir, geçerli çalışmayı temsil ettiğine inanmaktadır, ve yayınını onaylamaktadır. Ayrıca yayının editörleri çalışmanın dayandığı verileri talep ederlerse, hazırlamaları gerekir.

TEKZİP: Her yazar bu çalışmanın hakaret veya kanunsuz ifadeler içermediğini ve başkalarının haklarını ihlal etmediğini garanti eder. Telif hakkına tabi çalışmalardan alıntılar (metin, rakamlar, tablolar veya şekiller) dahilse, sunumdan önce yazarlar tarafından yazılı bir yayın verilir, ve orijinal yayına kredi uygun şekilde alındılanır. Her yazar çalışmayı takdim etmeden önce, isimleri veya fotoğrafları çalışmanın bir parçası olarak kullanılan hastalardan yazılı ibralarını aldığını garanti eder. Yayın Kurulu bu yazılı ibraların kopyalarını isterse yazarlar bunları sunmalıdır.

TELİF HAKKININ TRANSFERİ

YAZARLARIN KENDİ ÇALIŞMALARI: Türk Omurga Cerrahisi Dergisi çalışmayı yayınlaması halinde, yazarlar burada tüm dünyada, tüm dillerde ve CD-ROM, internet ve intranet gibi elektronik medya dahil tüm medya formlarında tüm telif hakkını Türk Omurga Cerrahisi Dergisi'ne transfer eder, devreder ve nakleder. Eğer Türk Omurga Cerrahisi Dergisi herhangi bir sebepten dolayı, bir yazarın çalışmaya takdimini yayınlamamaya karar verirse, yazışmayı yürüten yazara kararını bildiren notu hemen gönderir, bu anlaşma feshedilir, ne yazar ne de Türk Omurga Cerrahisi Dergisi başka sorumluluk veya yükümlülük altında olmaz. Yazarlar Türk Omurga Cerrahisi Dergisi'ne çalışmada ve çalışmanın veya yayının promosyonunda isimlerini ve biyografik verileri (profesyonel bağlantı dahil) kullanma haklarını verirler.

KİRA İÇİN YAPILMIŞ ÇALIŞMALAR: Eğer bu çalışma bir başka kişi veya kurum tarafından komisyonlandırılmışsa, veya bir çalışanın görevinin parçası olarak yazıldıysa, komisyon kurumunun yetkili bir temsilcisi veya çalışan kişi de kurumdaki unvanını belirterek bu formu imzalamalıdır.

FİNANSAL İFŞA: Her yazar, ayrı bir ek olarak ifşa edilmesi haricinde, takdim edilen makale ile ilişkili olarak bir çıkar çatışması olarak görülebilecek ticari bir ilişkisi (örneğin danışmanlık, hisse senedi sahipliği, sermaye ortaklığı, patent/lisans düzenlemeleri, vs) olmadığını doğrular. Çalışmayı destekleyen tüm fon temin kaynakları ve yazarların tüm kurumsal veya tüzel bağlar çalışmada bir dipnotta verilir.

KURUMSAL İNCELEME KURULU / HAYVAN

GÖZETİM KOMİTESİ ONAYI: Her yazar kendi kurumunun, hayvan veya insan içeren her türlü inceleme için protokolü kabul ettiğini ve tüm deneylerin etik ve insani araştırma ilkelerine uygun olarak yürütüldüğünü doğrular.

İmza	Basılı İsim	Tarih
İmza	Basılı İsim	Tarih
İmza	Basılı İsim	Tarih

TABLO-1. KANIT DÜZEYLERİ

DÜZEY- I .

1) İstatistiksel önemlilik testleri yapılan, vakaların randomize seçildiği, çift kör kontrol gruplarının yer aldığı deneysel çalışmalar

2) Vakaların % 80'den fazlasının kontrollere riayet ettiği tanı, tedavi ve prognostik kriterleri karşılaştıran vakaların randomize seçildiği, istatistiksel önemlilik testleri yapılan ileriye dönük planlanan (prospektif) klinik çalışmalar

3) Ardıl olgular için önceden seçilmiş kriterlerle istatistiksel önemlilik testleri yapılan, evrensel (altın standart) referanslarla mukayese edilen ileriye dönük klinik çalışmalar

4) Düzey – I çalışmaların iki veya daha fazlasının verilerini, önceden belirlenen yöntemlerle ve istatistikî olarak önemlilik testleri yapılarak karşılaştırılan sistematik inceleme (meta analiz) çalışmaları

5) Çok merkezli, randomize prospektif çalışmalar

DÜZEY –II.

1) Vakaların % 80'den azının çalışmaya alındığı randomize prospektif çalışmalar

2) Randomizasyon yapılmayan tüm Düzey-I çalışmalar

3) Randomize retrospektif klinik çalışmalar

4) Düzey-II çalışmaların meta- analizi

DÜZEY– III.

1) Randomizasyon yapılmayan düzey-II çalışmalar (prospektif klinik araştırmalar vb.)

2) Ardıl olmayan vakaların karşılaştırıldığı (tutarlı referans aralığı olmaksızın) klinik çalışmalar

3) Düzey III çalışmaların meta – analizi

DÜZEY- IV.

1) Olgu sunumları

2) Zayıf referans aralığı olan istatistiksel önemlilik verileri yapılmayan vaka serileri

DÜZEY – V.

1) Uzman görüşü

2) Bir çalışma hakkında kişisel deneyimlerin aktarıldığı bilimsel dayanağı olmaksızın bildiren görüş yazıları

TABLO-2. KLİNİK ALANLAR

- Makale
- Anatomi
- Temel Bilimler
- Biyomekanik
- Deformite
  - Skolyoz
  - Adölesan idiopatik
    - Kifoz
  - Konjenital
  - Dejeneratif
- Tanısal yöntemler
- Epidemioloji
- Fizik Tedavi
- Fonksiyon
  - Halk sağlığı
- Literatür gözden geçirme
- Meta-Analiz
- İş sağlığı
- Sonuçlar
- Tedavi
  - Konservatif tedavi
  - Primer tedavi
  - Yaşam kalitesi
  - Tedavi etkinliği
  - Pediatrik
  - Rehabilitasyon
  - Cerrahi
- Klinik cerrahi
  - Disk cerrahisi
  - Nöroşirurji
    - Rekonstriksiyon cerrahisi görüntüleme rehberliğinde cerrahi endoskopi
  - Başarısız omurga cerrahisi
  - Mikrocerrahi
  - BT yardımıyla
  - Minimal invazif
- Görüntüleme
  - Radyoloji
  - MRI
  - BT
- Füzyon
  - Füzyon kafesleri
  - Enstrümantasyon
  - Pedikül vidası
  - Fiksasyon
- Ağrı
  - Kronik ağrı
  - Bel ağrısı
  - Postoperatif ağrı
  - Ağrı ölçülü
  - Boyun ağrısı
  - Diskojenik ağrı
- Nöroloji
  - Nörofizyoloji
  - Nörolojik muayene
  - Nörokimya
  - Nöropatoloji
  - Kognitif nöroloji
  - Nöromusküler omurga hastalıkları
- Servikal omurga
  - Servikal miyolopati
  - Servikal rekonstrüksiyon
  - Servikal disk hastalığı
  - whiplash
  - Kraniyoservikal bileşke
  - Atlantoaksiyel
- Torasik omurga
  - Torakolomber omurga
- Lomber omurga
  - Lumbosakral bileşke
- Psikoloji
- Sinir
  - Sinir kökü
  - Siyatik
- Enjeksiyon
  - Epidural
- Diğer Hastalık
  - Metabolik kemik hastalıkları
  - Epilepsi
  - Lupus
  - Kanser
  - Parkinson
  - Tüberküloz
  - Romatoloji
  - Artrit
  - Osteoporoz
- Kemik
  - Kemik dansitesi
  - Kemik biyomekaniği
  - Kemik rejenerasyonu
  - Kemik grefti
  - Greft ürünleri
  - Kırık
- Disk
  - Disk dejenerasyonu
  - Herniye disk
  - Disk patolojisi
  - Disk replasmanı
  - Artifisial disk
  - IDET
- Travma
- Spinal kord
  - Spinal kord yaralanması
  - Klinik eğilimler
- Randomize çalışmalar
- Biyoloji
  - Biyokimya
  - Moleküler biyoloji
  - Tümör
  - Genetik
  - Stenoz
  - Enfeksiyon
  - Non-Operatif Tedavi
  - Hareket Analizi
  - Fizik Tedavi
  - Manüplasyon
  - Anestezi

INSTRUCTIONS TO AUTHORS

The Journal of Turkish Spinal Surgery (www.jtss.org), is the official publication of the Turkish Spinal Surgery Society. It is a peer-reviewed multidisiplinary journal for the physicians who deal with spinal diseases and publishes original studies which offer significant contributions to the development of the spinal knowledge. The journal publishes original scientific research articles, invited reviews and case reports that are accepted by the Editorial Board, in English or Turkish. The articles can only be published after being reviewed by at least two referees and Editorial Board has the right to accept, revise or reject a manuscript. The journal is published once in every three months and a volume consists of four issues.

The Journal of Turkish Spinal Surgery is published four times a year: on March, June, September, and December.

- Following types of manuscripts related to the field of "Spinal Surgery" with English Summary and Keywords are accepted for publication:

I- Original clinical and experimental research studies;

II- Case presentations; and

III- Reviews.

The manuscript submitted to the journal should not be previously published (except as an abstract or a preliminary report) or should not be under consideration for publication elsewhere. Every person listed as an author is expected to have been participated in the study to a significant extent. All authors should confirm that they have read the study and agreed to the submission to the Journal of Turkish Spinal Surgery for publication. This should be notified with a separate document as shown in the "Cover Letter" in the appendix. Although the editors and referees make every effort to ensure the validity of published manuscripts,

the final responsibility rests with the authors,

not with the Journal, its editors, or the publisher. The source of any financial support for the study should be clearly indicated in the Cover Letter.

It is the author's responsibility to ensure that a patient's anonymity be carefully protected and to verify that any experimental investigation with human subjects reported in the manuscript was performed upon the informed consent of the patients and in accordance with all guidelines for experimental investigation on human subjects applicable at the institution(s) of all authors. Authors should mask patients' eyes and remove patients' names from figures unless they obtain written consent to do so from the patients; and this consent should be submitted along with the manuscript.

Clinically relevant scientific advances during recent years include use of contemporary outcome measures, more sophisticated statistical approaches, and increasing use and reporting of well-formulated research plans (particularly in clinical research).

Scientific writing, no less than any other form of writing, reflects a demanding creative process, not merely an act: the process of writing changes thought. The quality of a report depends on the quality of thought in the design and the rigor of conduct of the research. Well-posed questions or hypotheses interrelate with the design. Well-posed hypotheses imply design and design implies the hypotheses. The effectiveness of a report relates to brevity and focus. Drawing the attention to a few points will allow authors to focus on critical issues. Brevity is achieved in part by avoiding repetition (with a few exceptions to be noted), clear style, and proper grammar. Few original scientific articles need to be longer than 3000 words. Longer articles may be accepted if substantially novel methods are reported, or if the article reflects a comprehensive review of the literature. Although authors should avoid redundancy, effectively communicating critical information often requires repetition of the questions (or hypotheses/key issues) and answers. The questions should appear in the Abstract, Introduction, and Discussion, and the answers should appear in the Abstract, Results, and Discussion sections.

Although most journals publish guidelines for formatting a manuscript and many have more or less established writing styles (e.g., the American Medical Association Manual of Style), styles of writing are as numerous as authors. The Journal of Turkish Spinal Surgery traditionally has used the AMA style as a general guideline. However, few scientific and medical authors have the time to learn these styles. Therefore, within the limits of proper grammar and clear, effective communication, we will allow individual styles.

- Permissions: As shown in the example in the appendix (Letter of Copyright Transfer) the authors should declare in a separate statement that the study has not been previously published and is not under consideration for publication elsewhere. Also, the authors should state in the same statement that they transfer copyrights of their manuscript to our Journal. Quoted material and borrowed illustrations: if the authors have used any material that had appeared in a copyrighted publication, they are expected to obtain written permission letter and it should be submitted along with the manuscript.

- Review articles: The format for reviews substantially differs from those reporting original data. However, many of the principles noted above apply. A review still requires an Abstract, an Introduction, and a Discussion. The Introduction still requires focused issues and a rationale for the

study. Authors should convey to readers the unique aspects of their reviews which distinguish them from other available material (e.g., monographs, book chapters). The main subject should be emphasized in the final paragraph of the Introduction. As for an original research article, the Introduction section of a review typically need not to be longer than four paragraphs. Longer Introductions tend to lose focus, so that the reader may not be sure what novel information will be presented. The sections after the Introduction are almost always unique to the particular review, but need to be organized in a coherent fashion. Headings (and subheadings when appropriate) should follow parallel construction and reflect analogous topics (e.g., diagnostic categories, alternative methods, alternative surgical interventions). If the reader considers only the headings, the logic of the review (as reflected in the Introduction) should be clear. Discussion synthesizes the reviewed literature as a whole coherently and within the context of the novel issues stated in the Introduction.

The limitations should reflect those of the literature, however, rather than a given study. Those limitations will relate to gaps in the literature which preclude more or less definitive assessment of diagnosis or selection of treatment, for example. Controversies in the literature should be briefly explored. Only by exploring limitations will the reader appropriately place the literature in perspective. Authors should end the Discussion by summary statements similar to those which will appear at the end of the Abstract in abbreviated form.

In general, a review requires a more extensive literature review than an original research article, although this will depend on the topic. Some topics (e.g., osteoporosis) could not be comprehensively referenced, even in an entire monograph. However, authors need to ensure that a review is representative of the entire body of literature, and when that body is large, many references are required.

- Original articles should contain the following sections: "Title Page", "Summary", "Keywords", "Introduction", "Materials and Methods", "Results", "Discussion", "Conclusions", and "References". Turkish "Summary" and "Keywords" sections should also be added if the original article is in English.

- Title (80 characters, including spaces): Just as the Abstract is important in capturing a reader's attention, so is the title. Titles rising or answering questions in a few brief words will far more likely do this than titles merely pointing to the topic. Furthermore, such titles as "Bisphosponates reduce bone loss" effectively convey the main message and readers will more likely remember them. Manuscripts that do not follow the protocol described here will be returned to the corresponding author for technical revision before undergoing peer review. All manuscripts, either in English or Turkish, should be typed double- spaced on one side of a standard typewriter paper, leaving at least 2.5 cm. margin on all sides. All pages should be numbered beginning from the title page.

- Title page should include: a) informative title of the paper, b) complete names of each author with their institutional affiliations, c) name, address, fax and telephone number, e-mail of the corresponding author, d) address for the reprints if different from that of the corresponding author. It should also be stated in the title page that informed consent was obtained from patients and that the study was approved by the ethics committee. The "Level of Evidence" should certainly be indicated in the title page (see Table 1 in the appendix). Also, the field of study should be pointed out as outlined in Table 2 (maximum three fields).

- Summary: A150 to 250 word summary should be included at the second page. The summary should be in Turkish for articles written in English and in Turkish for English articles. The main topics to be included in Summary section are as follows: Background Data, Purpose, Materials-Methods, Results and Conclusion. The English and Turkish versions of the Summary should be identical in meaning. Generally, an Abstract should be written after the entire manuscript is completed. The reason relates to how the process of writing changes thought and perhaps even purpose. Only after careful consideration of the data and a synthesis of the literature can author(s) write an effective abstract. Many readers now access medical and scientific information via Web-based databases rather than browsing hard copy material. Since the reader's introduction occurs through titles and abstracts, substantive titles and abstracts more effectively capture a reader's attention regardless of the method of access. Whether reader will examine an entire article often will depend on an abstract with compelling information. A compelling Abstract contains the questions or purposes, the methods, the results (most often quantitative data), and the conclusions. Each of these may be conveyed in one or two statements.Comments such as "this report describes..." convey little useful information.

-Key Words : Standard wording used in seientific indexes and search engines should be preferred. The minimum number for keywords is three and the maximum is five.

- Introduction (250 – 750 words): It should contain information on historical literature data on the relevant issue; the problem should be defined; and the objective of the study along with the problem solving methods should be mentioned.

The Introduction, although typically is the shortest ofsections, perhaps the most critical. The Introduction must effectively state the issues and formulate the rationale for tho-

se issues or questions. Its organization might differ some what for a clinical report, a study of new scientific data, or a description of a new method. Most studies, however, are published to: (1) report entirely novel findings (frequently case reports, but sometimes substantive basic or clinical studies); (2) confirm previously reported work (eg, case reports, small preliminary series) when such confirmation remains questionable; and (3) introduce or address controversies in the literature when data and/or conclusions conflict. Apart from reviews and other special articles, one of these three purposes generally should be apparent (and often explicit) in the Introduction.

The first paragraph should introduce the general topic or problem and emphasizet its importance, a second and perhaps a third paragraph should provide the rationale of the study, and a final paragraph should state the questions, hypotheses, or purposes.

One may think of formulating rationale and hypotheses as Aristotelian logic (a modal syllogism) taking the form: If A, B, and C, then D, E, or F. The premises A, B, and C, reflect accepted facts whereas D, E, or F reflect logical outcomes or predictions. The premises best come from published data, but when data are not available, published observations (typically qualitative), logical arguments or consensus of opinion can be used. The strength of these premises is roughly in descending order from data to observations or argument to opinion. D, E, or F reflects logical consequences. For any set of observations, any number of explanations (D, E, or F) logically follows. Therefore, when formulating hypotheses (explanations), researchers designing experiments and reporting results should not rely on a single explanation.

With the rare exception of truly novel material, when establishing rationale authors should generously reference representative (although not necessarily exhaustive) literature. This rationale establishes novelty and validity of the questions and places it within the body of literature. Writers should merely state the premises with relevant citations (superscripted) and avoid describing cited works and authors` names. The exceptions to this approach include a description of past methods when essential to developing rationale for a new method, or a mention of authors` names when important to establish historic precedent. Amplification of the citations may follow in the Discussion when appropriate. In establishing a rationale, new interventions of any sort are intended to solve certain problems. For example, new implants (unless conceptually novel) typically will be designed according to certain criteria to eliminate problems with previous implants. If the purpose is to report a new treatment, the premises of the study should include those explicitly stated problems (with quantitative frequencies when possible) and they should be referenced generously.

The final paragraph logically flows from the earlier ones, and should explicitly state the questions or hypotheses to be addressed in terms of the study (independent, dependent) variables. Any issue not posed in terms of study variables cannot be addressed meaningfully. Focus of the report relates to focus of these questions, and the report should avoid questions for which answers are well described in the literature (e.g., dislocation rates for an implant designed to minimize stress shielding). Only if there are new and unexpected information should data reported apart from that essential to answer the stated questions.

- Materials - Methods (1000-1500 words): Epidemiological/ demographic data regarding the study subjects; clinical and radiological investigations; surgical techniqueapplied; evaluation methods; and statistical analyses should be described in detail.

In principle, the Materials and Methods should contain adequate detail for another investigator to replicate the study. In practice, such detail is neither practical nor desirable because many methods will have been published previously (and in greater detail), and because long descriptions make reading difficult. Nonetheless, the Materials and Methods section typically will be the longest section. When reporting clinical studies authors must state approval of the institutional review board or ethics committees according to the laws and regulations of their countries. Informed consent must be stated where appropriate.Such approval should be stated in the first paragraph of Materials and Methods. At the outset the reader shouldgrasp the basic study design. Authors should only brieflyd escribe and reference previously reported methods. When authors modify those methods, the modificationsrequire additional description.

In clinical studies, the patient population and demographics should be outlined at the outset. Clinical reports must state inclusion and exclusion criteria and whether the series is consecutive or selected; if selected, criteria for selection should be stated. The reader should understandrom this description all potential sources of bias such as referral, diagnosis, exclusion, recall, or treatment bias. Given the expense and effort for substantial prospective studies, it is not surprising that most published clinical studies are retrospective.

Such studies often are criticized unfairly for being retrospective, but that does not negate the validity or value of a study. Carefully designed retrospective studies provide most of the information available to clinicians. However,authors should describe potential problems such as loss to follow-up, difficulty in matching, missing data,

and the various forms of bias more common with retrospective studies.

If authors use statistical analysis, a paragraph should appear at the end of Materials and Methods stating all statistical tests used. When multiple tests are used, authors should state which tests are used for which sets of data. All statistical tests are associated with assumptions, and when it is not obvious the data would meet those assumptions, the authors either should provide the supporting data (e.g., data are normally distributed, variances in groups are similar) or use alternative tests. Choice of level of significance should be justified. Although it is common to choose a level of alpha of 0.05 and a beta of 0.80, these levels are somewhat arbitrary and not always appropriate. In the case where the implications of an error are very serious (e.g., missing the diagnosis of a cancer), different alpha and beta levels might be chosen in the study design to assess clinical or biological significance.

- Results (250-750 words): "Results" section should be written in an explicit manner, and the details should be described in the tables. The results section can be divided into sub-sections for a more clear understanding.

If the questions or issues are adequately focused in the Introduction section, the Results section needs not to be long. Generally, one may need a paragraph or two to persuade the reader of the validity of the methods, one paragraph addressing each explicitly raised question or hypothesis, and finally, any paragraphs to report new and unexpected findings. The first (topic) sentence of each paragraph should state the point or answer the question. When the reader considers only the first sentence in each paragraph in Results, the logic of the authors` interpretations should be clear. Parenthetic reference to all figures and tables forces the author to textually state the interpretation of the data; the important material is the authors` interpretation of the data, not the data.

Statistical reporting of data deserves special consideration. Stating some outcome is increased or decreased(or greater or lesser) and parenthetically stating the p (or other statistical) value immediately after the comparative terms more effectively conveys information than stating something is or is not statistically significantly different from something else (different in what way? the readermay ask). Additionally, avoiding the terms 'statistically different' or 'sgnificantly different' lets the reader determine whether they will consider the statistical value biologically or clinically significant, regardless of statistical significance.

Although a matter of philosophy and style, actual p values convey more information than stating a value less than some preset level. Furthermore, as Motulsky notes,

"When you read that a result is not significant, don't stop thinking... First, look at the confidence interval... Second, ask about the power of the study to find a significant difference if it were there." This approach will give the reader a much greater sense of biological or clinical significance.

- Discussion (750 - 1250 words): The Discussion section should contain specific elements: a restatement of the problem or question, an exploration of limitations and assumptions, a comparison and/or contrast with information (data, opinion) in the literature, and a synthesis of the comparison and the author's new data to arrive atconclusions. The restatement of the problem or questions should only be a brief emphasis. Exploration of assumptions and limitations are preferred to be next rather than at the end of the manuscript, because interpretation of what will follow depends on these limitations. Failure to explore limitations suggests the author(s) either do not know or choose to ignore them, potentially misleading the reader. Exploration of these limitations should be brief, but all critical issues must be discussed, and the reader should be persuaded they do not jeopardize the conclusions.

Next the authors should compare and/or contrast their data with data reported in the literature. Generally, many of these reports will include those cited as rationale in the Introduction. Because of the peculiarities of a given study the data or observations might not be strictly comparable to that in the literature, it is unusual that the literature (including that cited in the Introduction as rationale) would not contain at least trends. Quantitative comparisons most effectively persuade the reader that the data in the study are "in the ballpark," and tables or figures efficiently convey that information. Discrepancies should be stated and explained when possible; when anexplanation of a discrepancy is not clear that also should be stated. Conclusions based solely on data in the paper seldom are warranted because the literature almost alwayscontains previous information. The quality of any re parisons.

Finally, the author(s) should interpret their data in the light of the literature. No critical data should be overlooked, because contrary data might effectively refute anargument. That is, the final conclusions must be consistent not only with the new data presented, but also that in the literature.

- Conclusion: The conclusions and recommendations by the authors should be described briefly. Sentences containing personal opinions or hypotheses that arenot based on the scientific data obtained from the study should be avoided.

- References: Care must be exercised to include references that are available in indexes. Data based on personal communication should not be included in the reference list. References should be arranged in alphabetical order and

be cited within the text; references that are not cited should not be included in the reference list. The summary of the presentations made at Symposia or Congresses should be submitted together with the manuscript. The following listing method should be used.

References should derive primarily from peer-reviewed journals, standard textbooks or monographs, or well-accepted and stable electronic sources. For citations dependent on interpretation of data, authors generally should use only high quality peer-reviewed sources. Abstracts and submitted articles should not be used because many in both categories ultimately do not pass peer review.

They should be listed at the end of the paper in alphabetical order under the first author's last name and numbered accordingly. If needed, the authors may be asked to provide and send full text of any reference. If the authors refer to an unpublished data, they should state the name and institution of the study, Unpublished papers and personal communications must be cited in the text. For the abbreviations of the journal names, the authors can apply to "list of Journals" in Index Medicus or to the address "http://www.nlm.nih.gov/tsd/serials/lji.html".

Please note the following examples of journal, bookand other reference styles:

Journal article:

1. Berk H, Akçalı Ö, Kıter E, Alıcı E. Does anterior spinal instrument rotation cause rethrolisthesis of the lower instrumented vertebra? J Turk Spin Surg 1997; 8 (1): 5-9.

Book chapter:

2. Wedge IH, Kirkaldy-Willis WH, Kinnard P. Lumbar spinal stenosis. Chapter 5. In: Disorders of the lumbar spine. Eds.: Helfet A, Grubel DM. JB Lippincott, Philadelphia 1978, pp: 61-68.

Entire book:

3. Paul LW, Juhl IH. The essentials of Roentgen interpretation. Second Edition, Harper and Row, New York 1965, pp: 294-311.

Book with volume number:

4. Stauffer ES, Kaufer H, Kling THF. Fractures and dislocations of the spine. In: Fractures in Adults. Vol 2. Eds.: Rockwood CA, Green DP, JB Lippincott, Philadelphia 1984, pp: 987-1092.

Journal article in press:

5. Arslantaş A, Durmaz R, Coşan E, Tel E. Aneurysmal bone cysts of the cervical spine. J Turk Spin Surg (In press).

Book in press:

6. Condon RH. Modalities in the treatment of acute and chronic low back pain. Low back pain. Ed.: Finnison BE, JB Lippincott (In press).

Symposium:

7. Raycroft IF, Curtis BH. Spinal curvature in myelomeningocele: Natural history and etiology. Proceedings of the American Academy of Orthopaedic Surgeons Symposium on Myelomeningocele, Hartford, Connecticut, November 1970, CV Mosby, St. Louis 1972, pp: 186- 201.

Papers presented at the meeting:

8. Rhoton AL. Microsurgery of the Arnold-Chiari malformation with and without hydromyelia in adults. Presented at the annual meeting of the American Association of Neurological Surgeons, Miami, Florida, April 7, 1975.

- Tables: They should be numbered consecutively in the text with Arabic numbers. Each table with its number and title should be typed on a separate sheet of paper.Each table must be able to stand alone; all necessary information must be contained in the caption and the table itself so that it can be understood independent from the text. Information should be presented explicitly in "Tables" so that the reader can obtain a clear idea about its content. Information presented in "Tables" should not be repeated within the text. If possible, information in "Tables" should contain statistical means, standard deviations, and t and p values for possibility. Abbreviations used in the table should be explained as a footnote.

Tables should complement not duplicate material in the text. They compactly present information, which would be difficult to describe in text form. (Material which may be succinctly described in text should rarely be placed in tables or figures.) Clinical studies for example, of ten contain complementary tables of demographic data, which although important for interpreting the results, are not critical for the questions raised in the paper. Well focused papers contain only one or two tables or figures for every question or hypothesis explicitly posed in the Introduction section. Additional material may be used for unexpected results. Well constructed tables are self-explanatory and require only a title. Every column contains a header with units when appropriate.

- Figures: All figures should be numbered consecutively throughout the text. Each figure should have a label pasted on its back indicating the number of the figure, an arrow to show the top edge of the figure and the name f

the first author. Black-and-white illustrations should be in the form of glossy prints (9x13 cm). The letter size on the figure should be large enough to be readable after the figure is reduced to its actual printing size. Unprofessional typewritten characters are not accepted. Legends to figures should be written on a separate sheet of paper after the references.

The journal accepts color figures for publication if they enhance the article. Authors who submit color figures will receive an estimate of the cost for color reproduction. If they decide not to pay for color reproduction, they can request that the figures be converted to black and white at no charge. For studies submitted by electronic means, the figures should be in jpeg and tiff formats with a resolution greater than 300 dpi. Figures should be numbered and must be cited in the text.

- Style: For manuscript style, American Medical Association Manual of Style (9th edition). Stedman's Medical Dictionary (27th edition) and Merriam Webster's Collegiate Dictionary (10th edition) should be used as standard references. The drugs and therapeutic agents must be referred by their accepted generic or chemical names, without abbreviations. Code numbers must be used only when a generic name is not yet available. In that case, the chemical name and a figure giving the chemical structure of the drug should be given. The trade names of drugs should be capitalized and placed in parentheses after the generic names. To comply with trademark law, the name and location (city and state/country) of the manufacturer of any drug, supply, or equipment mentioned in the manuscript should be included. The metric system must be used to express the units of measure and degrees Celsius to express temperatures, and SI units rather than conventional units should be preferred.

The abbreviations should be defined when they first appear in the text and in each table and figure. If a brand name is cited, the manufacturer's name and address (city and state/country) must be supplied.

The address, "Council of Biology Editors Style Guide" (Council of Science Editors, 9650 Rockville Pike, Bethesda, MD 20814) can be consulted for the standard list of abbreviations.

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Begin with, "The Authors wish to thank…" All forms of support, including pharmaceutical industry support should also be stated in Acknowledgments section.

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- Practical Tips:

1. Read only the first sentence in each paragraph throughout the text to ascertain whether those statements contain all critical material and the logical flow is clear.

2. Avoid in the Abstract comments such as, "... this report describes..." Such statements convey no substantive information for the reader.

3. Avoid references and statistical values in the Abstract.

4. Avoid using the names of cited authors except to establish historical precedent. Instead, indicate the point in the manuscript by providing citation by superscripting.

5. Avoid in the final paragraph of the Introduction purposes such as, "... we report our data..." Such statements fail to focus the reader's (and author's!) attention on the critical issues (and do not mention study variables).

6. Parenthetically refer to tables and figures and avoid statements in which a table of figure is either subject or object of a sentence. Parenthetic reference places emphasison interpretation of the information in the table or figure, and not the table or figure.

7. Regularly count words from the Introduction through Discussion.

Application Letter Example:

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The Journal of Turkish Spinal Surgery

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TABLE-1. LEVELS OF EVIDENCE

LEVEL- I .

1) Randomized, double-blind, controlled trials for which tests of statistical significance have been performed

2) Prospective clinical trials comparing criteria for diagnosis, treatment and prognosis with tests of statistical significance where compliance rate to study exceeds 80%

3) Prospective clinical trials where tests of statistical ignificance for consecutive subjects are based on predefined criteria and a comparison with universal (gold standard) reference is performed

4) Systematic meta-analyses which compare two or more studies with Level I evidence using pre-defined methods and statistical comparisons.

5) Multi-center, randomized, prospective studies

LEVEL –II.

1) Randomized, prospective studies where compliance rate is less than 80%

2) All Level-I studies with no randomization

3) Randomized retrospective clinical studies

4) Meta-analysis of Level-II studies

LEVEL– III.

1) Level-II studies with no randomization (prospective clinical studies etc.)

2) Clinical studies comparing non-consecutive cases (without a consistent reference range)

3) Meta-analysis of Level III studies

LEVEL- IV.

1) Case presentations

2) Case series with weak reference range and with no statistical tests of significance

LEVEL – V.

1) Expert opinion

2) Anecdotal reports of personal experience regarding a study, with no scientific basis

TABLE-2. CLINICAL AREAS

Article
Anatomy
Basic Science
Biomechanics
Deformity
- Scoliosis
- Adolescent idiopathic
  - Kyphosis
- Congenital spine
- Degenerative spine conditions

Diagnostics
Epidemiology
Exercise Physiology and Physical Exam
Functional Restoration
Health Services Research
Literature Review
Meta-Analysis
Occupational Health
Outcomes
Patient Care
- Conservative care
- primary care
- quality of life research
- treatment efficacy
- pediatric
- rehabilitation

Surgery
- clinical surgery
- intradiscal surgery
- neurosurgery
- reconstructive surgery
- image guided surgery
- endoscopy
- failed spine surgery
- microsurgery
- computer-assisted
- minimally-invasive

Imaging
- radiology

- MRI
- CT scan

Fusion
- fusion cages
- instrumentation
- pedicle screws
- fixation

Pain
- chronic pain
- low back pain
- postoperative pain
- pain measurement
- neck pain
- discogenic pain

Neurology
- neurophysiology
- neurological examination
- neurochemistry
- neuropathology
- cognitive neuroscience
- neuromuscular spine

Cervical Spine
- cervical myelopathy
- cervical reconstruction
- cervical disc disease
- whiplash
- craniocervical junction
- atlantoaxial

Thoracic Spine
- thoracolumbar spine

Lumbar Spine
- lumbosacral spine

Psychology

Nerve
- nerve root
- sciatica

Injection
- epidural

Disease/Disorder
- metabolic bone disease
- epilepsy
- lupus
- cancer
- Parkinson's
- tuberculosis

Rheumatology
- arthritis
- osteoporosis

Bone
- bone density
- bone mechanics
- bone regeneration
- bone graft
- bone graft sustitutes
- fracture

Disc
- disc degeneration
- herniated disc
- disc pathology
- disc replacement
- artificial disc
- IDET

Trauma

Spinal cord
- spinal cord injury

Clinical trials

Randomized trials

Biology
- biochemistry
- biomaterials
- molecular biology

Tumor

Genetics

Stenosis

Infection

Non-Operative Treatment

Motion Analysis

Physical Therapy

Manipulation

Anethesiology

CONTENT / *İÇİNDEKİLER*

JTSS 26 (3), JULY 2015

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pp. xxx-xxx

EDITORIAL / *EDİTÖRDEN*

Dear Colleagues,

We sincerely wish the summer of 2015 brings peace, happiness and health to all my colleagues and their families. We are happy to accomplish the third issue of 2015.

There are 6 research articles in this issue. The first one is a clinical study analyzing for results of the surgical treatment of scoliosis on shoulder asymmetry. The second, third and fourth studies are about the lumbar degenerative disease and lumbar spinal stenosis. Surgical treatment of thoracic outlet syndrome is discussing in fifth article. In the sixth study, the results of pain management with radiofrequency thermoablation for coccydinia were presented. We believe that all those studies will quietly interest the readers.

There are also one case reports in this issue which is anterior cervical hyperosteosis due to dysphagia.

There are three reviews in this issue. The first one is a review presenting the studies about the corrective surgery of the spinal deformity using of video assisted thoracoscopy, and the second one presents the fail back syndrome. Third one is about the complications of the vertebroplasty. All of them are quiet comprehensive and informative reviews.

In this issue, in the "Frontiers of the Spinal Surgery" section, the biography was presented about the Prof. Azmi Hamzaoğlu. The authors of the this article are Prof. İ. Teoman Benli and Assoc. Prof. Yener Erken.

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. Mehmet Aydoğan will perform the headship this year and Yunus Atıcı performs the secretariat, will be continued. You can find the other meeting contents from the announcements section.

We respond to answer the STE questions that we publish in accordance with the request from TOTBİD TOTEK for recertif ication in this issue. The answers of the questions included in this issue should be sent to cutku@ada.net.tr or admin@jtss.org.tr addresses as also indicated in the page including the questions. The sent answers will be sent to the secretariat working relevantly in TOTBİD TOTEK by us.

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

The Journal of Turkish Spinal Surgery

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pp. 191-196

ORIGINAL ARTICLE / *ORJİNAL MAKALE*

EFFECT OF POSTOPERATIVE SHOULDER IMBALANCE ON PATIENT SATISFACTION WITH SURGICAL TREATMENT OF ADOLESCENT IDIOPATHIC SCOLIOSIS

ADÖLESAN İDİYOPATİK SKOLYOZDA CERRAHİ SONRASI OMUZ DENGESİZLİĞİNİN HASTANIN TEDAVİDEN MEMNUNİYETİ ÜZERİNE ETKİSİ

Olcay GULER[1], Erhan BAYRAM[2], Murat YILMAZ[2], Mehmet Emin ERDIL[1], Ali Akın UGRAS[1], Mahir MAHIROGULLARI[1]

SUMMARY

Objective: We aimed to evaluate whether there is a relation between the level of shoulder imbalance after scoliosis surgery and patients' satisfaction with treatment.
Materials and methods: Twenty-three patients with adolescent idiopathic scoliosis (18 females, 5 males; mean age, 15.9 years; age range, 13-24 years), who were treated by posterior instrumentation and fusion and followed up for an average of 35.4 months (range, 24-67 months) postoperatively, were included in this retrospective clinical study. In order to evaluated shoulder balance on coronal plane, three parameters were measured on postoperative radiography: first rib angle, radiographical shoulder height, and clavicle angle. For the assessment of patients' satisfaction with scoliosis surgery, Scoliosis Research Society (SRS)-22r Patient Questionnaire was used.
Results: Fusion was obtained in all patients. On radiography, mean first rib angle was 2.5º±2.8º, shoulder height was 6.0±5.4 mm, and clavicle angle was 1.7º±1.5º. The mean values for SRS-22r domain scores were between 3.3 and 3.8, being lowest for mental health and highest for pain and self-image. There was no significant correlation between radiographic parameters and total or domain scores of SRS-22r.
Conclusions: Shoulder imbalance is a common undesirable effect of correcting thoracic curve in surgical treatment of adolescent idiopathic scoliosis. However, unless it is severe, shoulder imbalance does not cause patient dissatisfaction.

Keywords: Adolescent idiopathic scoliosis; shoulder imbalance; SRS-22r; thoracic curve

Level of evidence: Retrospective clinical study, Level III

ÖZET

Amaç: Bu çalışmada skolyoz cerrahisi sonrası oluşan omuz dengesizliğinin düzeyi ile hastaların tedaviden memnuniyeti arasında bir ilişki olup olmadığını değerlendirmeyi amaçladık.
Materyal-Metod: Bu retrospektif klinik çalışmaya, posterior enstrümentasyon ve füzyon ile tedavi edilen ve cerrahi sonrası ortalama 35.4 ay (aralık, 24-67 ay) izlenen 23 adölesan idiyopatik skolyoz hastası (18 kadın, 5 erkek; ortalama yaş, 15.9 yıl; yaş aralığı, 13-24 yıl) dahil edildi. Koronal düzlemde omuz dengesini değerlendirmek için, posoperatif radyografide üç parametre ölçüldü: ilk kaburga açısı, radyografik omuz yüksekliği ve klavikula açısı. Hastaların skolyoz cerrahisinden memnuniyetlerini değerlendirmek için, Skolyoz Araştırma Derneği (SRS)-22r Hasta Anketi kullanıldı.
Bulgular: Tüm hastalarda füzyon sağlanmıştr. Radyografide ortalama ilk kaburga açısı 2.5º±2.8º, omuz yüksekliği 6.0±5.4 mm ve klavikula açısı 1.7º±1.5º ölçülmüştür. Ortalama SRS-22r domain skorları 3.3 ile 3.8, arasında değişirken, en düşük skor mental sağlık, en yüksek skor ise ağrı ve kendi imaj/görüşü için kaydedilmiştir. Radyografik parametreler ile SRS-22r toplam ve domain skorları arasında anlamlı korelasyon bulunamamıştır.
Sonuç: Adölesan idiyopatik skolyozda cerrahisinde torasik eğriliğin düzeltilmesinin sıkça rastlanan istenmeyen etkisi omuz dengesizliğidir. Ancak bu dengesizlik şiddetli olmadığı sürece, hastalarda tedaviden memnuniyetsizliğe neden olmaz.

Anahtar Sözcükler: Adölesan idiyopatik skolyozda; omuz dengesizliği; SRS-22r; torasik eğrilik

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

[1] Orthopedics and Traumatology Department, Medipol University, Medical Faculty, Istanbul, Turkey
[2] Orthopedics and Traumatology Department, Haseki Training Hospital, Istanbul, Turkey

INTRODUCTION:

Adolescent idiopathic scoliosis (AIS) is a common abnormality of the spinal curve with an overall prevalence of 0.47-5.2 % (8). Although recent advances in surgical techniques allow good correction of the main thoracic curve and provides sagittal balance in AIS, curve correction may cause one shoulder to elevate leading to shoulder imbalance (12,13). Postoperative shoulder imbalance is even more common with better correction of the main thoracic curve (12).

Although frequency and extent of shoulder imbalance following surgical correction of AIS were well reported (10,13), studies in literature on the relation between shoulder imbalance and clinical outcome and patient's perception of spine deformity are limited. Matamalas et al. recently claimed that shoulder balance is not a key factor in patients' perception of spinal deformity in non-operated, moderate AIS cases and that this perception is not correlated with clinical balance (11). However, studies on the role of shoulder balance in clinical outcome and patients' satisfaction need to be increased to conclude on the clinical importance of shoulder balance and to further investigate necessary measures to prevent this undesirable effect of surgical correction of AIS.

Therefore, in this study we aimed to evaluate whether there is a relation between the level of shoulder imbalance after scoliosis surgery and patients' satisfaction with treatment.

MATERIALS AND METHODS:

Patients and study design:

Twenty-three patients with AIS (18 females, 5 males; mean age, 15.9 years; age range, 13-24 years), who were treated by posterior instrumentation and fusion and followed postoperatively at a single center between 2009-2012, were included in this retrospective clinical study. The inclusion criteria were T2 (thoracic vertebra 2) proximal fusion level, stable vertebrae with C7 plumb line at 10 mm on frontal plane, patients who are able to stand on foot for radiography, and ensuring fusion in instrumentation region. The exclusion criteria were inability to measure on posteroanterior radiography, mental retardation, history of revision surgery, and neuromuscular scoliosis. The etiology of scoliosis was AIS in 21 patients and congenital scoliosis in 2 patients. According to Lenke classification for idiopathic scoliosis (9), curve types of patients were listed in Table-1.

Table-1. Demographic and clinical characteristics of scoliosis patients included in the study

Characteristics		Result
Number of patients		23
Follow-up duration (months)		35.4±13.7 (range, 24-67)
Age (years)		16.00±3.680 (range, 16-30)
Gender	Male	5 (21.7%)
	Female	18 (78.3%)
Lenke's curve type of scoliosis	1	5 (21.7%)
	2	5 (21.7%)
	3	4 (17.4%)
	4	1 (4.3%)
	5	3 (13.0%)
	6	3 (13.0%)
	Congenital	2 (8.7%)
Surgical operation	T2-L3 fusion	9 (39.1%)
	T2-L1 fusion	6 (20.7%)
	T2-L4 fusion	5 (17.2%)
	T2-T12 fusion	2 (6.8%)
	T2-L2 fusion	1 (3.4%)

All patients or legal representatives signed the informed consent form. The study was approved by the Institutional Ethics Committee and conducted in accordance to the latest version of Helsinki Declaration.

Surgical procedure:

All the surgical operations were performed by a single surgeon (A.A.U.). The surgical technique was posterior instrumentation by using polyaxial pedicle screw through posterior approach. The posterior fusion was performed with auto and allogenic cancellous bone after decortication of the lamina.

Radiographic parameters:

All the patients had preoperative standing posteroanterior radiography in a relaxed standing position with hands supported in front and with elbows bended to accommodate shoulder flexion to approximately 30º. In order to evaluated shoulder balance on coronal plane, three parameters were measured on postoperative radiography: first rib angle, radiographical shoulder height, and clavicle angle.

First rib angle is the tilt of a tangential line that connects both the superior borders of first ribs. A positive first rib angle value indicates an inclination to the right of this reference line (Figure-1).

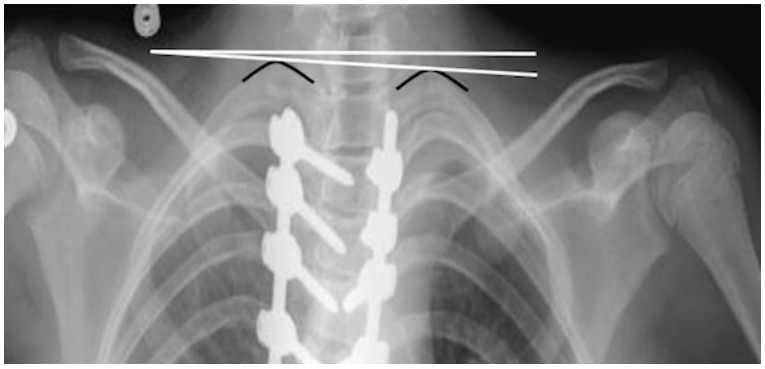

Figure-1. Measurement of first rib angle on posteroanterior radiography. It is the tilt of a tangential line that connects both the superior borders of first ribs.

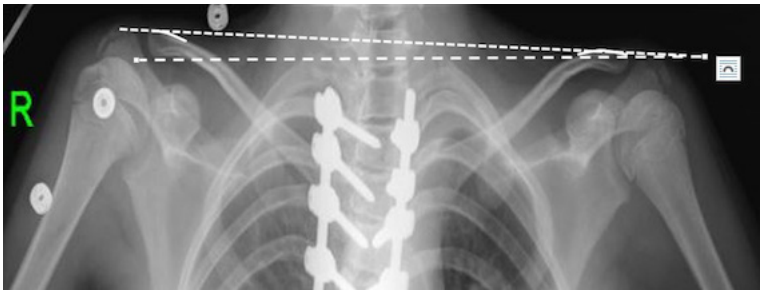

Figure-2. Measurement of clavicle angle on posteroanterior radiography. It is the angle between the horizontal line and the tangential line connecting the highest two points of each clavicle.

Radiographical shoulder height is the difference in millimeters in the soft tissue shadow directly superior to the acromioclavicular joint (6). Clavicle angle is the angle between the horizontal line and the tangential line connecting the highest two points of each clavicle (Figure-2). When the left clavicle up and the right clavicle down, clavicle angle show positive values (14).

Assessment of patient satisfaction:

For the assessment of patients' satisfaction with scoliosis surgery, Scoliosis Research Society (SRS)-22r Patient Questionnaire was used. The SRS-22r is a valid instrument for the assessment of the health related quality of life of patients with scoliosis (2). It has five domains, each scoring between 1 (worst) and 5 (best): function, pain, self-image, mental health, and satisfaction with management. Turkish version of SRS-22r has been shown to be valid and reliable (1).

Statistical analysis:

Study data were summarized by descriptive statistics (mean, standard deviation, range, frequency, and percentage). The correlations between SRS-22r domain scores and radiographic parameters were analyzed by Spearman correlation coefficient (r). Statistical level of significance was set to $p<0.05$. All analyses were performed by using MedCalc Statistical Software (MedCalc Software bvba, version 12.7.7, Ostend, Belgium).

RESULTS:

The mean C7 plumb line value on frontal plane was 4.8 mm (range, 0-9 mm). The level of proximal instrumentation and fusion ended at T2 for all patients, while distal instrumentation and fusion level was L3 (lumbar vertebra 3) in 9 patients, L1 in 6 patients, L4 in 5 patients, T12 in 2 patients, and L2 in 1 patient (Table-1). Fusion was obtained in all patients. Patients were followed up for an average of 35.4 months (range, 24-67 months) postoperatively.

On radiography, mean first rib angle was 2.5°±2.8°, shoulder height was 6.0±5.4 mm, and clavicle angle was 1.7°±1.5° (Table-2). The mean values for SRS-22r domain scores were between 3.3 and 3.8, being lowest for mental health and highest for pain and self-image (Table 2). There was no significant correlation between radiographic parameters and total or domain scores of SRS-22r ($p>0.05$ for all, Table-3).

Table-2. Radiographic parameters and SRS-22 scores of study patients

	Results [Mean±standard deviation (median, min-max)]	
Radiographic parameters		
First rib angle (°)	2.5±2.8	(2, 0-10)
Shoulder height (mm)	6.0±5.4	(4, 0-14)
Clavicle angle (°)	1.7±1.5	(1, 0-5)
SRS-22r scores		
Pain	3.8±0.8	(4.0, 1.8-5.0)
Self-image	3.8±0.6	(3.8, 2.6-4.8)
Function	3.7±0.7	(4.0, 2.2-4.8)
Mental health	3.3±0.9	(3.4, 1.0-4.8)
Satisfaction with management	3.7±1.1	(4.0, 2.0-5.0)
Total	3.6±0.7	(3.8, 1.9-4.8)

Table-3. Correlation between radiographic parameters and SRS-22r scores as correlation coefficient (r) and corresponding p value

Radiographic parameters	SRS-22r score					
	Pain	Self image	Function	Mental health	Satisfaction with management	Total
First rib angle	r=0.306 p=0.156	r=0.058 p=0.791	r=0.299 p=0.165	r=-0.033 p=0.882	r=-0.239 p=0.271	r=0.046 p=0.834
Shoulder height	r=-0.050 p=0.821	r=0.037 p=0.867	r=-0.113 p=0.165	r=-0.251 p=0.248	r=-0.243 p=0.265	r=-0.184 p=0.400
Clavicle angle	r=-0.078 p=0.725	r=0.109 p=0.620	r=-0.081 p=0.714	r=-0.126 p=0.567	r=-0.196 p=0.370	r=-0.105 p=0.634

DISCUSSION:

As biomechanical understanding of curve patterns in AIS and surgical techniques improve over time, scoliosis surgery has provided satisfying outcome (5). In particular, the development of instrumentation with pedicle screw provided optimal correction of thoracic curve, but also led to hypercorrection in some cases resulting in coronal imbalance, trunk shift, and shoulder imbalance (7). Ideally, the optimal level of curve correction should provide coronal and sagittal alignment without causing undesirable effects of hypercorrection. In order to determine this optimal level of correction, the clinical and cosmetic impacts of hypercorrection, like shoulder imbalance should be known.

However, it is not clear whether postoperative shoulder imbalance has any significant clinical and functional impact and cause dissatisfaction of patients in long-term. Some studies claim that shoulder imbalance (elevation over 2 cm) is a potential cause of dissatisfaction (15), while some suggested that shoulder imbalance has not a principal role in patients' self-perception (11). However, no study focused on the relation between postoperative shoulder imbalance parameters and patients' satisfaction with treatment.

In the present study, we obtained fusion at all spinal levels, which is indicative of a successful scoliosis surgery by posterior instrumentation using polyaxial pedicle screw. The radiographic parameters (first rib angle, shoulder height, and clavicle angle) revealed that patients had mild to moderate postoperative shoulder imbalance at long-term follow-up (24-67 months). In literature, postoperative radiographic parameters for shoulder imbalance showed a range of values depending on preoperative level of shoulders, the surgical technique, and follow-up duration. In a large series on 619 patients with AIS, preoperative T1 tilt increased from -0.10° to 2.42°, clavicle angle from -1.39° to 0.79°, and radiographic shoulder height from -7.04 mm to 1.63 mm (10). In 106 patients with Lenke type 1A curve, Matsumoto et al. (12) reported clavicle angle and T1 tilt angle as 1.8°±2.1° and 3.4°±5.5° at postoperative follow-up. Namikawa et al. (13) found that radiographic shoulder height improved from preoperative -12.3 mm to +5.7 mm after posterior fusion with segmental pedicle screws in 24 patients with AIS. We determined postoperative first rib angle as 2.5°±2.8°, shoulder height as 6.0±5.4 mm, and clavicle angle as 1.7°±1.5°.

In the study by Namikawa et al. (13), radiographic shoulder height of 20 mm and over was defined as shoulder imbalance, which occurred in 7 out of 24 patients (29%) immediately postoperatively, most of which improved on long-term follow-up. Smyrnis et al. (15) reported postoperative shoulder elevation in 25% of 56 AIS patients, and that half of those with moderate imbalance (≥1 cm shoulder elevation) expressed dissatisfaction. In contrary, we found that there was no significant correlation between shoulder imbalance and patients' satisfaction with treatment, which was evaluated by SRS-22r. The postoperative SRS-22r scores in our population ranged from 3.3 and 3.8, being lowest for mental health and highest for pain and self-image. These scores were similar to postoperative SRS-22r scores reported in the previous studies (4).

In order to improve surgical balance, additional correction methods, such as direct vertebral rotation, were suggested, but no significant effect has been reported with these techniques (3). Currently less correction of the distal thoracic curve seems to be the only effective method to achieve better shoulder balance. However, our finding of insignificant effect of shoulder imbalance on patients' satisfaction may lead to questioning the need for limiting curve correction and taking interventional measures to prevent shoulder imbalance.

The main limitation of the present study was its small sample size, which precludes us from reaching a definitive conclusion on the relation between shoulder imbalance and patients' satisfaction with treatment. Another important limitation need to be noted is the lack of preoperative data, which does not allow the evaluation of the surgery-induced change on both shoulder imbalance and patients' satisfaction. Nevertheless, this is the first study focusing on the role of shoulder imbalance in patients' satisfaction with surgical treatment of AIS.

In conclusion, one of the aims in surgical treatment of scoliosis is achieving shoulder balance. We can say that imbalance in radiographical shoulder height up to 15 mm and at first rib angle up to 10°, and difference between the each shoulder's clavicle angle values up to 5° do not cause patient dissatisfaction in AIS in this relatively small series.

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ORIGINAL ARTICLE / *ORJİNAL MAKALE*

EFFECTIVITY OF INTERBODY FUSION PROCEDURE IN DEGENERATIVE SPINE DISEASES

DEJENERATİF OMURGA HASTALIKLARINDA CİSİMLERARASI FÜZYONUN ETKİNLİĞİ

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SUMMARY

Objective: The effectively of interbody fusion as a surgical treatment option on the degenerative spine disease and assessment of results.
Patients and Methods: 56 patients who were diagnosed with degenerative spine and treated using interbody fusion in our institute. Anterior-posterior projection and lateral lumbosacral and CT projections were used for radiologic evaluation of patients. Preoperative and postoperative intervertebral disc height, lumbar and segmental lordosis angle and fusion were measured for radiological assessment. Preoperative and postoperative VAS and ODI scores were measured for functional assessment.
Results: Decreases in VAS and ODI scores before and after operation were significant. Increases in intervertebral disc height and lumbar lordosis angle before and after operation were significant. In all patients we have seen circumferential fusion. Adjacent segment degeneration reported in 19 patients. But ODI scores and lumbar lordosis angles between patients who had ASD and no ASD were not significant.
Conclusions: We found effectiveness interbody fusion procedure in our study for the treatment of degenerative spine disease.

Key words: Degenerative lumbar diseases, surgical treatment, fusion, interbody fusion

Level of evidence: Retrospective clinical study, Level III

ÖZET

Amaç: Dejeneratif omurga hastalıkları cerrahi tedavileri arasında yer alan cisimler arası füzyon ameliyatının sonuçları ve etkinliğinin değerlendirilmesi.
Hastalar ve Yöntemler: 1995 - 2010 tarihleri arasında kliniğimize başvuran, dejeneratif omurga hastalığı tanısı konulup posterior yaklaşımla cisimler arası füzyon ameliyatı yapılan 56 hasta retrospektif olarak değerlendirildi. Hastaların radyografik ölçümlerinde standart olarak çekilen lumbosakral AP-lateral, lumbosakral lateral fleksiyon ve ekstansiyon grafileri ile bilgisayarlı tomografi kesitleri kullanıldı. Hastaların radyografik değerlendirilmesinde, preop ve postoperatif intervertebral disk yükseklikleri, lomber ve segmental lordoz açıları ile kaynama durumlarına bakıldı. Hastaların fonksiyonel değerlendirilmesinde ODI ve VAS skorları kullanıldı.
Sonuçlar: Hastaların preop VAS değerleri ve ODI skorlarında postoperatif anlamlı olarak iyileşme saptandı. Hastaların preop intervertebral disk yükseklikleri, lomber lordoz açılarında postoperatif anlamlı olarak artış ve iyileşme görüldü. Hastaların tümünde son kontrollerde tam füzyon elde edildiği görüldü. 56 hastanın 19'unda KSD saptandı. KSD ile ODI skorları ve lomber lordoz açıları arasında anlamlı bir ilişki saptanmadı.
Sonuç: Dejeneratif omurga hastalığının cerrahi tedavisinde anterior destek yerleştirilerek elde edilen cisimler arası füzyon işlemi diskojenik ağrıların giderilmesi, orjinal disk yükseklikleri ve foramen çaplarının korunması ile sagittal dengenin geri kazanılmasında etkin ve güvenilir bir yöntemdir.

Anahtar Kelimeler: Dejeneratif lomber hastalıklar, cerrahi tedavi, füzyon, cisimler arası füzyon

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

INTRODUCTION:

A degenerative spine may cause various complaints and symptoms, for which objective examination findings are hard to come by. In many cases, findings obtained by methods such as computed tomography or magnetic resonance imaging may not accord with clinical ones (21).

During the process of degeneration, the spine goes through the following morphological stages: dysfunction, instability and immobilization. Disk degeneration eliminates the hydrostatic quality of the disk, as a result of which, it loses its resistance to physiological loads and triggers simultaneous degenerative changes in facet joints. In sum, a set of complex pathologies occur, such as subchondral sclerosis, osteophytes, closer anterior vertebral bodies, and spinal canal stenosis (3). These may be regarded a natural result of spinal aging. The etiology of disk degeneration and concomitant degenerative spine diseases is not

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yet clear, and despite the many treatment options that exist, their effectiveness is still debated.

In this study, we investigated the effectiveness of interbody fusion surgery performed in our clinic by evaluating pre- and postoperative pain and life comfort experienced by patients, and intervertebral disk space and union in postoperative follow-up.

PATIENTS AND METHOD:

Here, we retrospectively investigated the files of a total of 56 patients with a mean age of 54,4 years (21-77) who had been diagnosed with degenerative spine disease and underwent posterior interbody fusion surgery at Istanbul University Istanbul Medical School, Department of Orthopaedics and Traumatology between January 1995 and January 2010. Patient assessment included preop anamnesis and epicrisis information, clinical examination findings, direct graphs, MR and CT images. In the final control, all patients were assessed with respect to clinical examination findings, direct graphs and CT images. Clinical assessment relied on VAS and ODI scoring. In all patients' preop and postoperative lumbosacral lateral graphs, intervertebral disk space was taken as the distance between the upper and lower end-plates in the middle of disk balance. Lordosis angle and segmental lordosis angles were measured from preop and postoperative standing lateral lumbar graphs. Lumbar lordosis angle was determined by measuring the angle between a perpendicular line to one drawn from the upper plate of the first vertebra and a similar perpendicular line to one drawn from the upper end-plate of the first sacral vertebra. Segmental lordosis angle was determined by measuring the angle between a perpendicular line to one drawn from the upper end-plate of the upper vertebra of the segment that received interbody fusion and a similar perpendicular line to one drawn from the lower end-plate of the lower vertebra (Figure-1).

Full fusion was accepted when final postoperative follow-up lateral graphs and computed tomography displayed bone bridge between the two vertebra in the fusion area, and flexion extension graphs showed no movement.

The age range of our patients was 21-77 years, with a mean of 54.4. Of our 56 cases, 41 (73 %) were female and 15 (27 %) male. Patients were followed

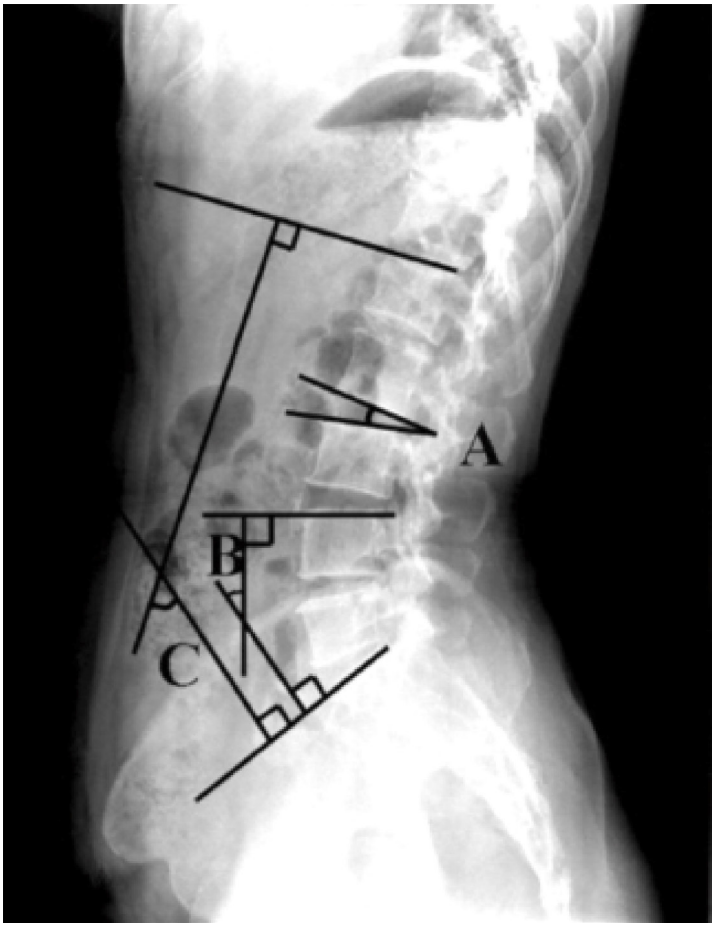

Figure-1. Measurement of lumbar lordosis angle and segmental lordosis angle

for an average of 66 months (8-230 months). Etiology was specified as spinal stenosis in 25 patients, degenerative spondylolisthesis in 14, novo scoliosis in 2, and discogenic pain related to degenerative disk disease in 15. Twenty eight patients underwent PLIF, and the remaining 28 underwent TLIF surgery. While 39 patients received single level interbody fusion, 17 received double level interbody fusion. All patients received posterior instrumentation with pedicle screws in the same session as interbody fusion. The distribution of posterior instrumentation level by patient number is displayed in the table.

The results were analyzed by using SPSS (Statistical Package for Social Sciences) for Windows 12.0. In addition to descriptive statistics (mean and standard deviation), student t-test and Paired Sample t tests were used t compare quantitative data. Qualitative data, on the other hand, were compared by using the Chi-Square and Fisher's Exact Chi-Square tests. The results were evaluated in a 95% confidence interval, and $p<0,05$ was considered significant.

In the visual analog scale used for pain assessment, the visual preop mean value was 7,4 and postoperative 2,9. The ODI survey given out to measure functional assessment revealed a preop high of 91 and low 60 (mean 74,5), while the postoperative high was 66 and low 9 (mean 31,2).

RESULTS:

During clinical examination, preop and postoperative VAS mean scores were found as 7,4 and 2,9, respectively. The change in the VAS scores was significant ($p<0,05$). The preop-postoperative ODI mean scores of patients were 74,5 and 31,23, respectively. The change in ODI scores was also significant ($p<0,05$).

The lateral lumbosacral graphs of our patients revealed preop intervertebral disk heights between minimum 2 mm and maximum 11 mm (mean 5,46 mm), while postoperative heights ranged between minimum 8 mm and maximum 15 mm (mean 11.18).

In preop standing lateral x-rays, patients' lumbar lordosis angles ranged between minimum 4 and maximum 37 (mean 20,34) and, in postoperative, they ranged between minimum 12 and maximum 51 (mean 32.41). The difference between preop and postoperative lumbar lordosis angles was statistically significant. In preop standing lumbar lateral graphs, patients' segmental lumbar lordosis angles ranged between minimum 3,8 and maximum 27,7 (mean 12,6), while postoperative they ranged between minimum 5,4 and maximum 34,2 (mean 19,7) (Table 1).

Table-1. TLLA ve SLA preoperative and postoperative

	PREOPERATİVE MEAN	POSTOPERATIVE MEAN
Lumbar lordosis angle	20,34 (4-37)	32,41 (12-51)
Segmental lordosis angle	12,6 (3,8-27,7)	19,7 (5,4-34,2)

In radiological assessment, patients' mean intervertebral disk height was 5,46 mm preop and 11,18 mm postoperative. The difference between intervertebral disk height was significant ($p<0,05$).

In final follow-up, x-rays and CT images showed full union in all 56 patients (Figure-2).

Radiologically, final CT images and x-rays showed adjacent segment degeneration in 19 (37,3 %) of the 56 patients. The postoperative ODI scores of patients with

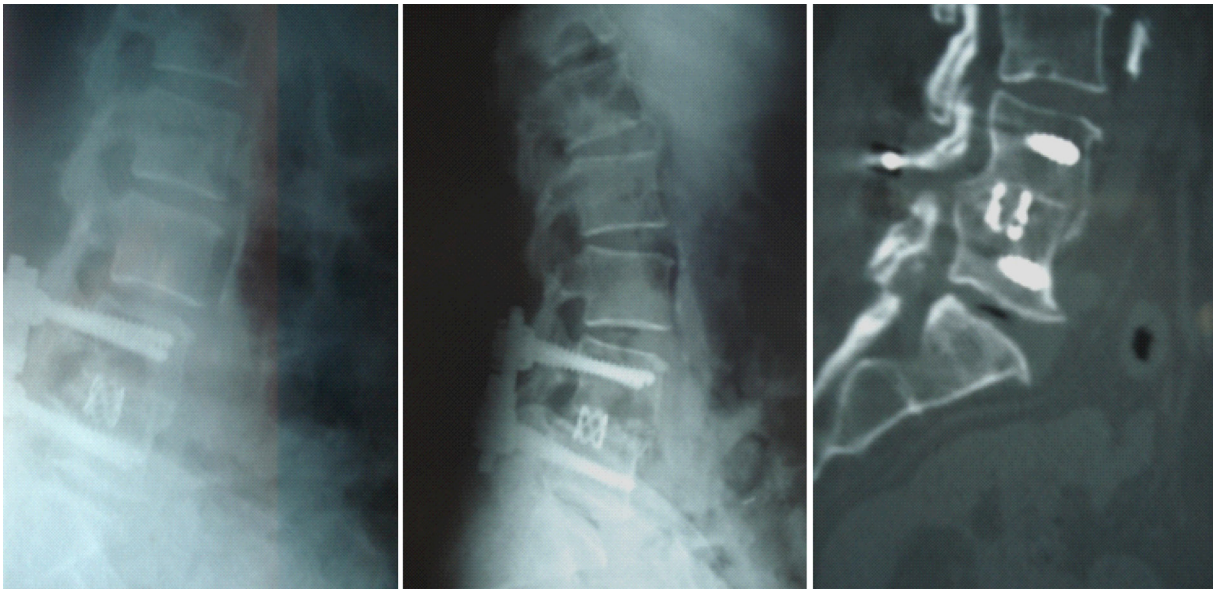

Figure-2. Postoperative flexion and extansion lateral xrays and CT.

and without adjacent segment degeneration were compared. Mean postoperative ODI score was 32,57 in the KSD group, and 30,54 in the non-KSD group. In either group, postoperative ODI scores did not vary significantly (p>0,05). Postoperative lumbar lordosis of ASD and non-ASD groups was compared. Postoperative lumbar lordosis angle was 32.65 in the ASD group, and 32,22 in the non-ASD group. Postoperative lumbar lordosis angles did not vary significantly in either group (p>0,05).

While narrowness occurred in one patient in the opposite foramen, another one experienced dural injury which was restored through surgery, and another experienced superficial infection. Other than the patient who developed symptomatic narrowness in the opposite foramen, no other patient needed a second surgery. This patient underwent foraminotomy 10 days after primary surgery. Superficial infection was controlled with antibiotic therapy.

DISCUSSION:

The etiology of disk degeneration and concomitant degenerative spine diseases is not yet clear, and despite the many treatment options that exist, their effectiveness is still debated. As the etiology is not known, treatment methods target problems, or complications, created by the pathological process, rather than aiming to shape the course of the disease. Conservative treatments aim to alleviate pain, decrease stimulation of the nerve or disk, and improve the physical condition of the patient for spinal protection (10).

In order to tackle pain in degenerative spine diseases, the underlying pathology needs first be identified. If this pathology results from an irritation in a nerve root, such as in disk hernia, it may often be eliminated with ease through simple discectomy. However, if disk hernia is accompanied by a pathological motion in the movement segment or mechanical pain, a discectomy may eliminate radicular symptoms for a certain time but not alleviate pain. Also, while a simple laminectomy may improve neural claudication in older central spinal stenosis patients with severely limited segmental mobility during the stabilization stage of degeneration, the same outcome cannot be obtained in younger patients of spinal stenosis with segmental hyper mobility without using instrumental fusion in addition to decompression (23). Therefore, the problem needs to be fully clarified, and treatment methods should be selected and used accordingly.

Lumbar fusion surgery is a treatment method that particularly aims at the elimination of the pathological segmental mobility during the instability stage of degeneration and the symptoms caused by this. Compared to conservative treatment or decompression alone, fusion has yielded better results ever since the early 1990s (10,17).

To illustrate, Herkowitz et al. studied 50 patients and concluded that fusion was superior to conservative treatment and decompression alone with respect to both clinical and disease progression dimensions (25).

Mardjetko et al. reviewed 889 spinal stenosis patients with accompanying spondylolisthesis, and found a clinical recovery rate of 90 % with fusion but 69 % with compression (14). In 2001, Fritzell et al. compared surgical treatment and conservative treatment in 294 patients with chronic discogenic back pain and found that the fusion group yielded significantly better clinical results (7).

However, considering the biomechanical structure of the spine and the fact that load distribution mostly happens from the middle colon and fusion requires a larger surface, it is obvious that posterolateral fusion may not be adequate. This brings forward interbody fusion. Many previous studies have shown its advantages.

Yashiro et al. reported a union rate of 60 % in the month 11 follow-up of their PL fusion patients. In PLIF patients, 91 % union was found in month 6 follow-up. Additionally, there was more improvement and sagittal balance in the PLIF group (28). Brantigan et al. followed their PLIF patients for 10 years and reported a union rate of 96.7 % and a significant clinical recovery rate of 87 % (2).

La Rosa et al. studied 35 spondylolisthesis patients and found significantly better union and radiological improvement parameters (disk height, correction, subluxation) in the PLIF group, but no significant difference with respect to clinical functional results (19). Similarly, Xiuxin et al. compared interbody fusion and posterolateral fusion in a 2009 meta analysis and found no significant difference between the two groups regarding clinical functional results, but significant fusion rates in the interbody fusion group (92.4%) than PL (85.7%) (26). Glassman et al. studied 497 patients in 2006 and found no significant difference between PLF, ALIF VE PLIF/TLIF groups considering SF 36 and ODI scale (8).

We have obtained 100 % union in the patients in our series, a mean 5,72 mm increase in disk height, and an improvement of 12,07 and 7,1 degrees in lumbar lordosis and segmental lordosis angles, thus supporting the biological and biomechanical benefits of interbody fusion.

Our clinical findings revealed a significant increase in ODI (preoperative mean 74.48 postoperative mean 31.23) and VAS (preop mean 7.37 postoperative mean 2.93), revealing the effectiveness of the intervention.

The presence of many indications for interbody fusion and its recent popularity has triggered debates. Among the complications mentioned are dural injury (particularly for PLIF), pseudoarthrosis, infection and cage migration (11,25). Greiner et al. followed 1,680

PLIF patients for 5 years and found a pseudoarthrosis rate of 4.5%, a wound problem of 1.5%, and an implant insufficiency rate of 1.2%. Dural injury was only seen in one patient (9).

Anand et al., in a 2006 study, detected no dural injury or implant insufficiency in 100 patients that undertook TLIF. They reported full fusion in 99 patients (1). In our series, we detected dural injury in one patient, and superficial infection treated with antibiotic therapy in another. No patient requires re-operation due to these complications.

Adjacent segment degeneration is a popular debate in interbody fusion, which centers around two factors. The first is the belief that degenerative disk disease results from genetic factors and adjacent segment degeneration is a part of its natural course. The second is the claim that fusion creates mechanical stress in the adjacent segment, leading to or exacerbating degeneration. It may be noted that while radiological findings of degeneration exist in the majority of patients who underwent fusion in almost all series, not all display similar and equal clinical symptoms. Therefore, radiological symptoms are usually defined as "adjacent segment degeneration", and those that display clinical symptoms as "adjacent segment disease".

Several biomechanical studies have shown that interbody fusion increases intradiscal pressure in other segments by changing loads in end-plates, thus leading to degeneration particularly in the cranial segment.

Cunningham et al. published an in vitro biomechanical study in 1998 in which they found a 45% increase in the intradiskal pressure in the proximal of the segment where fusion was performed, but could not associate this increase with the level of degeneration in the adjacent segment (5). Lee et al. found in 1988 that lumbar fusion increases adjacent segment degeneration (13).

However, a parallelism between adjacent segment degeneration and clinical findings is another debate. In 2008, Yang et al. examined 217 patients retrospectively and found a clinical correlation with ASD. They reported less favorable clinical functional results in patients with ASD (27). On the other hand, in 2006, Okuda et al. reported a ASD rate of 22% in a study with 109 patients and found no correlation between radiological degeneration and clinical functional results (16).

Schulte et al. followed 27 patients who received lumbar fusion due to DDD for 10 years. Even though they concluded that adjacent segment disk space was significantly reduced thus leading to adjacent segment degeneration, they could not correlate this significantly with clinical functional results (20). Wai et al. published a 20-year follow-up study of 39 ALIF patients in 2006, in which they reported adjacent segment degeneration in 23% but no correlation between radiological degeneration and functional results (22).

In recent years, several studies have attempted to determine risk factors to prevent adjacent segment degeneration. Some authors have associated age, sex, length of fusion level, sagittal alignment, and menopause to ASD (18).

Okuda et al. studied 87 patients and found no correlation between ASD and age, sacral inclination and bone density (15). While Djurasoviç et al. (6) found sagittal alignment as a major risk factor; Kumar et al. reported a correlation between ASD and increased sacral inclination angle and length of fusion level (12).

In 2011, Chen et al. reported 22% ASD in 109 patients who underwent single level fusion. Having examined many risk parameters such as age, bone mineral density, sacral inclination angle, lumbar lordosis angle, intervertebral disk height and movement in fusion level and its upper level, they correlated ASD only to age, concluding that age increases the risk of developing ASD (4).

In our study, we found that a mean postoperative ODI score of 30.54 among non-ASD patients as opposed to 32.57 in patients who developed ASD. The difference was not significant. It should be remembered that sagittal balance is an important factor in preventing symptomatic ASD. Our results corroborate the literature regarding the effectiveness of interbody fusion in providing and maintaining segmental lordosis.

Degenerative spine diseases currently affect a large part of the population and their treatment is essential to patients having comfortable daily lives. Despite the presence of many treatment methods for degenerative spine diseases, supporting disk space and union in the anterior and interbody fusion surgeries are the gold standard in treatment as they eliminate discogenic pain, restore disk height and open the foramen, and restore local sagittal balance. The literature shows that long-term results of non fusion methods are still inadequate. In this study, we evaluated the effectiveness of interbody fusion, which is a routine procedure in our clinic. We saw full fusion in all patients. Additionally, complaints of pain in follow-up controls were significantly reduced as compared to preop and the functional state of patients was improved. Radiologically, we found that lumbar lordosis was restored and a local lordosization effect was obtained after the surgery. Even though in our series we detected 37 % adjacent segment degeneration, which is a widely mentioned side effect of interbody fusion in the literature, we found no significant relationship with respect to clinical and radiological results.

In light of these findings and the latest literature mentioned in the discussion, we recommend interbody fusion surgery in degenerative spine patients with instability and pain. This surgery improves pain, sagittal balance, and functional outcomes. More clinical large comparative cohort series are needed to confirm these results.

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ORIGINAL ARTICLE / *ORJİNAL MAKALE*

UNILATERAL APPROACH FOR BILATERAL SPINAL MICRODECOMPRESSION IN LUMBAR SPINAL STENOSIS: SHORT TERM RESULTS

LOMBER DAR KANAL HASTALARINDA UNILATERAL YAKLAŞIM ILE BILATERAL MIKRODEKOMPRESYON: KISA DÖNEM SONUÇLARI

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SUMMARY

Objective: Lumbar spinal stenosis is a frequent cause of back and leg pain in patients over 50. Stenosis can be caused by congenital lesions or degenerative changes. Degenerative spinal stenosis may be due to intervertebral disk bulging, joint facet hypertrophy, thickening of the ligamentum flavum and spondylolisthesis.
Materials and Method: We observed 28 patients retrospectively. All patients have back and/or leg pain with neurogenic claudication. The patients were scored by numerical pain scale with zero to ten that zero is no pain and ten is the worst. During the surgeries all stenosis levels treated by unilateral approach with bilateral microdecompression.
Results: At the end of 1 month follow up, all of the patients got rid of the neurogenic claudication. The pain release rate was 86%.Many literature analysis results are similar when inspected.
Conclusions: The main point of the unilateral approach bilateral microdecompression for treating lumbar spinal stenosis is minimal invasive surgery with satisfactory decompression.

Key Words: Chronic Low Back Pain, Spinal Stenosis, Unilateral Approach Bilateral Microdecompression.

Level of evidence: Retrospective clinical stuıdy, Level III

ÖZET

Amaç: Lomber spinal dar kanal hastalığı 50 yaş üstünde sırt e bacak ağrısının en çok görülen sebeplerinden biridir. Dar kanal konjenital lezyonlar sonucu oluşabileceği gibi dejeneratif sebeplerle de oluşabilmektedir. Dejeneratif spinal dar kanal a yol açan sebepler intervertebral diskin taşması, faset eklem hipertrofisi, ligamentum flavum hipertrofisi ve spondilolistezis olarak sayılabilir.
Materyal ve Metod: 28 hastayı retrospektif olarak inceledik. Tüm hastalarda sırt veya bacak ağrısının yanında nörojenik kladikasyo bulunmaktaydı. Hastalar 0 dan 10 a kadar olan 0 ağrısız ve 10 en çok ağrı olmak üzere numaralandırılmış ağrı skorlaması ile değerlendirildi. Cerrahi uygulanan seviyelerde unilateral yaklaşım ile bilateral mikrodekompresyon uygulandı.
Sonuçlar: Hasta takiplerinin 1. ayın sonunda tüm hastaların nörojenik kladikasyosu iyileşmişti. Ağrı azalma oranı %86 olarak bulundu. Literatürdeki çoğu çalışmayı destekler sonuçlar elde edilmiştir.
Çıkarım: Unilateral yaklaşım ile bilateral mikrodekompresyon ile tedavinin dikkat çekici noktası minimal invaziv yaklaşım ile tatmin edici dekompresyon elde edilmesidir.

Anahtar kelimeler: Kronik bel ağrısı, Spinal dar kanal, Unilateral yaklaşım ile bilateral mikrodekompersyon.

Kanıt düzeyi: Retrospektif klinik çalışma, Düzey III

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INTRODUCTION:

Chronic low back pain and radiating leg pain caused by various spinal degenerative diseases such as herniated nucleus pulposus, lumbar spinal stenosis, and internal disc derangement results in decreasing function and increasing physical impairment in adults (1). Lumbar spinal stenosis is a frequent cause of back and leg pain in patients over 50(8). Stenosis can be caused by congenital lesions or degenerative changes. De enerative spinal stenosis may be due to intervertebral disk bulging, joint facet hypertrophy, and thickening of the ligamentum flavum or spondylolisthesis (5).

The most objective method in diagnosing spinal stenosis is magnetic resonance imaging. Symptoms of spinal stenosis can be back and leg pain with or without neurogenic claudication. The only treatment option available to patients who fail to respond to nonoperative therapies that may include epidural steroid injections, oral steroids, nonsteroidal antiinflammatory medication, analgesics and physical therapy is decompressive surgery (7,9,10).

MATERIALS AND METHOD:

We observed 28 patients retrospectively. All patients have back and/or leg pain with neurogenic claudication. The patients were scored by visual analog scale with zero to ten that zero is no pain and ten is the worst. Patients diagnosed with magnetic resonans imaging and they don't have disc herniation, vertebral fractures or listesis (Figure-1.a,b).

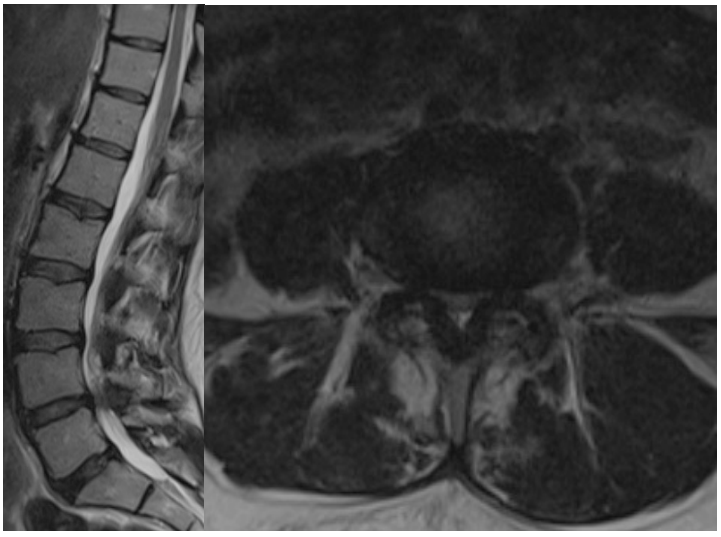

Figure-1.a,b. Preoperative magnetic resonance imaging sagittal image(left) and axial image (right).

During the surgeries all stenosis levels treated by unilateral approach with bilateral microdecompression (Figure-2.a,b).

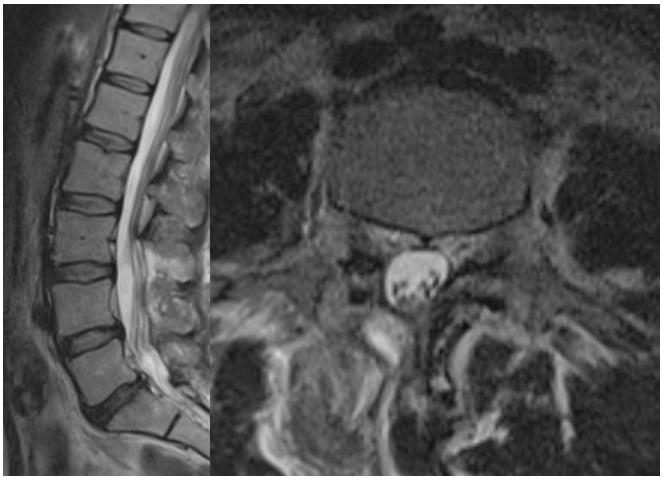

Figure-2.a,b. Postoperative magnetic resonance imaging sagittal image(left) and axial image(right)

Neither total laminectomy nor spinal instrumentation had been used. With a month of follow up the patients were scored again. The difference between the scores were calculated for pain release.

Statistical Analyses:

Descriptive data of VAS scores were presented as mean, standard deviation. The categorical variable gender was presented as frequency and percent. The comparisons between independent two groups were conducted by Mann-Whitney U test. The changes during the follow-ups were compared by using Friedman test, and when a statistically significant difference was observed, post-hoc analyses were performed by Wilcoxon test with Bonferroni correction. SPSS software version 21 (IBM Inc., USA) was used for the statistical analyses. Statistical significance level was considered as 0.05 in the analyses of this study.

RESULTS:

This study included 28 patient with a mean age of 66.4±8.9 years. There were 14 patients from each gender. Mean ages of the females was 68±8.8 years, and males was 64.7±9.4 years. There were no significant differences between the ages of the patients (p=0.443).

The mean preoperative, postoperative 1st month, and postoperative 6th month VAS values were 8.5±0.6, 1.9±0.6, and 1.6±0.4, respectively. The comparison of these were presented in Table 1. The comparisons between genders revealed that there were no significant differences between males and females (p>0.05 for all).

Table-1. VAS scores according to gender

	Female	Male	p
Preoperative	8.4±0.9	8.5±0.2	0.653
Postoperative 1st month	1.8±0.7	2.1±0.4	0.222
Postoperative 6th month	1.5±0.3	1.8±0.4	0.199

Table-2. VAS scores through the follow-ups

	Preoperative	Postoperative 1st month	Postoperative 6th month	p
VAS	8.5±0.6	1.9±0.6	1.6±0.4	<0.001

Table-3. Post-hoc comparisons of VAS scores

	p
Preoperative - Postoperative 1st month	0.001
Preoperative - Postoperative 6th month	0.001

The VAS scores measured during the study were presented in Table-2. The overall comparisons showed that VAS scores changed during the study course (p<0.001). The post-hoc comparisons (Table-3) revealed that changes in postoperative 1st and 6th month scores were significant when compared with preoperative baseline values (p=0.001 for all). The VAS scores were significantly decreased during the follow-ups (Figure-3).

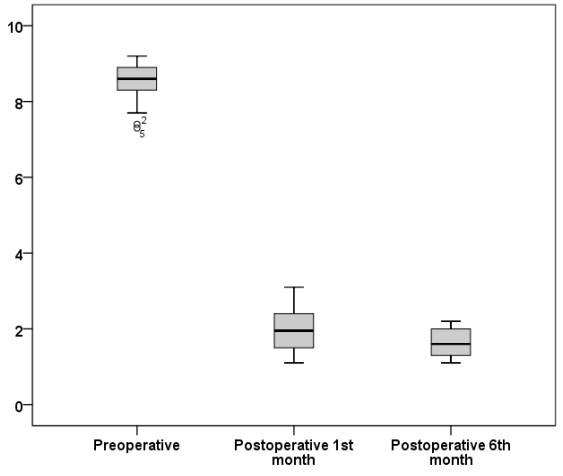

Figure-3. VAS scores through the follow-ups

DISCUSSION:

Lumbar canal stenosis is usually a disease of elderly patients. The typical clinical symptoms are chronic lower back pain radiating to the buttock, leg pain or sciatica, as well as neurogenic claudication intensifying with fatigue. Although such patients are unable to walk a long distance because of increasing numbness and leg pain, they can resume walking after squatting for a few minutes. Neuroradiological examinations including CT or MRI show reduction of the midsagittal diameter of the spinal canal to less than 12 mm and/or stenosis of the lateral recesses or the intervertebral foramen (4,14).

Haba et al. achieved bilateral decompression of the central and lateral lumbar spinal canal while preserving the anatomy and the biomechanical function of the posterior spinal column in a consecutive series of 450 patients.They reported a significant increase in standing time and walking distance in all patients, except for two, for up to three years postoperatively (6).

Spetzger et al. has successfully used unilateral laminotomy and bilateral spinal canal decompression approach in the operative treatment of 29 patients with symptomatic mono or multisegmental lumbar stenosis (12). Postoperatively, 25 of the 27 patients with neurogenic claudication (93 %) demonstrated a marked improvement of the walking distance. The followup of 25 patients for 18 months demonstrated an excellent result without pain in 7 patients (28 %); a good outcome with mild residual pain, but a normal working capacity in 15 patients (60 %); and a fair outcome with unchanged postoperative lowback pain but markedly improved working capacity and walking distance in 3 patients (12 %).

Cavusoglu et al. have conducted a prospective study to evaluate the results and effectiveness of bilateral decompression via a unilateral laminectomy in 50 patients with 98 levels of degenerative lumbar spinal stenosis without instability using the Visual Analog Scale, Oswestry Disability Index, Short Form–36, and subjective Satisfaction Measurement (3). Patient satisfaction rate was 94 %, and its improvement rate was 96 % with the mean followup time of 22.8 months.

Sahinoglu et al. had inspected 18 patients with spinal stenosis that treated with unilateral laminotomy bilateral decompression for 3 years (13). They used visual analog scale and Prolo functional score for comparison. Postoperative measurements for spinal canal and scores were statistically significant for unilateral approach is useful.

Although the conventional open techniques of decompression currently remain the gold standard for treatment, problems with paraspinal musculature denervation and resultant lumbar instability have focused attention on less invasive technique (2). Minimally invasive surgery is crucial not only for reducing tissue trauma and patient morbidity but also for improving pain and reducing postoperative stress responses and delayed complications after otherwise uneventful procedures (11,15). In accordance with the current general tendency towards minimally invasive surgery, the present techniques may be most indicated for the surgical treatment of multilevel lumbar canal stenosis in the elderly (6).

The main point of the unilateral approach bilateral microdecompression for treating lumbar spinal stenosis is minimal invasive surgery with satisfactory decompression.

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ORIGINAL ARTICLE / *ORJİNAL MAKALE*

ALL LEVELS PEDICLE SCREW FOR DECOMPRESSION AND CORRECTION IN DEGENERATIVE LUMBAR SPINE SCOLIOSIS: SHORT-TERM RESULTS

DEJENERATİF LOMBER OMURGA SKOLYOZUNDA KORREKSİYON VE DEKOMPRESYONUNDA TÜM SEVİYELERE PEDİKÜLER VİDA KULLANIMI

Uzay ERDOGAN[1], Hakan KINA[1],
Orhun M. CEVIK[1], A. Ender OFLUOGLU[1]

SUMMARY

Introduction: Degenerative lumbar scoliosis is a slow progressed scoliosis most commonly seen in over 40 year adults. Degenerative or de novo lumbar scoliosis is defined as over 10 degrees of Cobb angle bent spine in adults with completed spine development sans having adolescent idiopathic scoliosis. Increased pain with movement is a common symptom along with walking irregularities and intermittent claudication like neurologic symptoms. Ideally spine should be fused in all segments contributing to the deformity.
Method: Our Study includes 20 patients operated between years 2012-2014 with lumbar degenerative scoliosis diagnosis. The patients are retrospectively studied. 15 women, 5 men with an age average of 57 (46-82). The average follow-up is 16.3 months (8-36). Pre and postoperative VAS and ODI scores are used for assessment. Radiologic control of the patients was done using calculated Cobb's angle from standing scoliosis images and L1-S1 lumbar lordosis angles.
Results: The calculated preoperative average Cobb's angles of the patients were 22.6 (15-40) with postoperative average has fallen to 4.8 (0-10). The preoperative average L1-S1 lumbar lordosis angle of the patients was 30.8 (15-45) and significant lordosis loss was noted. Postoperative average L1-S1 lordosis angle were calculated to be 40.3 (25-55). Preoperative average VAS was 7.8(7-9) with the postoperative average 2.4(0-4). Preoperative average ODI was 54 % (46-74 %) with the postoperative resulting average of 18% (12-30 %).
Conclusion: With the patients that are picked right, the correction of the scoliosis operation renders good results. We can say that with the correctly chosen patients the lumbar degenerative scoliosis correction operation with decompression and instrumentation is a correct treatment option.

Key Words: Degenerative lumbar scoliosis, coronal balance, correction.

Level of Evidence: Retrospective clinical study, Level III

ÖZET

Giriş: 40 yaş üstü popülasyonda görülen, yavaş seyirli bir skolyoz tipidir. Dejeneratif veya de novo lomber skolyoz, adelösan idiopatik skolyoz olmaksızın iskelet maturasyonu tamamlandıktan sonra 10 derecenin üstünde Cobb açısı bulunan anormal omurga eğriliği olarak tanımlanır. Hareketle artan bel ağrısı tipik klinik bulgusu olup buna radikülopati, yürüme bozukluğu, intermittan kladikasyo gibi çeşitli nörolojik semptomlar da eşlik edebilir. İdeal yöntem, koronal planda deformiteye katılan tüm segmentlere füzyon uygulamaktır.
Materyal-Metot: Çalışmamızda 2012-2014 yılları arasında dejeneratif lomber skolyoz tanısı ile opere edilen 20 hasta retrospektif olarak değerlendirildi. Hastaların 15'i kadın, 5'i erkek, yaş ortalaması 57 (46-82) idi. Hastaların ortalama takip süresi 16.3 ay (8-36) olup klinik olarak pre ve postoperatif VAS ve ODI skalaları ile değerlendirildi. Hastaların radyolojik kontrolü preoperatif ve postoperatif olarak ayakta skolyoz grafilerinde ölçülen Cobb açıları ve L1-S1 lomber lordoz açısı ile yapıldı.
Sonuçlar: Hastaların ölçülen preoperatif ortalama Cobb açısı 22.6 (15-40) derece idi. Postoperatif ortalama Cobb açısı 4.8 (0-10) derece olarak ölçüldü. Hastaların preoperatif L1-S1 lomber lordoz açısı ortalama 30.8 (15-45) derece olup belirgin lordoz kaybı olduğu saptandı. Postoperatif L1-S1 lomber lordoz açısı ortalama 40.3 (25-55) derece olarak ölçüldü. Preoperatif ortalama VAS 7.8 (7-9) iken postoperatif 2.4 (0-4)'e geriledi. Preoperatif ortalama ODI % 54 (46-74) iken postoperatif % 18 (12-30)'e geriledi.
Çıkarım: Doğru seçilmiş hastalarda skolyoz korreksiyonu ile başarılı sonuçlara ulaşabiliriz. Lomber dejeneratif skoyoz cerrahisinde enstrümantasyon, dekompresyon ve koreksiyon uygun seçilmiş vakalarda tatmin edici bir cerrahi tedavi seçeneğidir.

Anahtar Kelimeler: Dejeneratif lomber skolyoz, koronal balans, dekompresyon, korreksiyon,

Kanıt düzeyi: Retrospektif klinik çalışma, Düzey III.

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INTRODUCTION:

Degenerative or de novo lumbar scoliosis is defined as over 10 degrees of Cobb angle bent spine in adults with completed spine development sans having adolescent idiopathic scoliosis. Asymmetrical disc degeneration, facet joint degeneration, lumbar stenosis and segmental instability are lumbar degenerative scoliosis' most common causes (1-4,28).

Degenerative lumbar scoliosis (DLS) is a slow progressed scoliosis most commonly seen in over 40 year adults. Incidence and prevalence are both increased with age. With today's advanced imaging techniques and increased awareness of the population results in an increase in rates (14,22,31).

DLS has a prevalence of 6 % above ages 50 and up (32). Different surgical techniques are present for patients requiring surgical intervention. These differences arise from the differences of patients' radiological findings and expected outcome of living quality and function. Increased pain with movement is a common symptom along with walking irregularities and intermittent claudication like neurologic symptoms. Like other degenerative pathologies, conservative approach is also manageable for DLS (30). Alas, patients requiring surgical intervention, conservative approach leads to further progress of the DLS. Furthermore, surgical decompression treatment to patients with only radicular pain leads to spine imbalance and worsen the symptoms in the long run (10,12). Ideally, surgical fusion to all segments contributing to the deformity in coronal plane should be performed. For the proximal segment, the first neutral level above the deformity should be chosen (27). The aim of this retrospective study is to see the results of the surgical decompression and correction of all the levels with pedicle screws with radiological imaging and functional satisfaction of the patient.

MATERIAL AND METHOD:

Our Study includes 20 patients operated between years 2012-2014 with lumbar degenerative scoliosis diagnosis. The patients are retrospectively studied. 15 women, 5 men with an age average of 57 (46-82). Most of the patients were found to be in 5th and 6th decades. The average length of the symptoms was 7.8 years (3-20). The main symptom among all patients was back pain within 3 patients' pain in the apex of the scoliosis and 17 with diffuse pain through all the back. In all patients, radiculopathy with differing degrees and claudication in similar lengths were present. All patients received medical and physical treatment before surgical intervention. None of the patients had apparent motor deficit.

Radiological assessment was done with 2 way standing scoliosis images, dynamic lumbar images, MRI and CT scans. All patients received surgical treatment with posterior stabilization with pedicle screws on all levels, and posterior decompression and interbody lumbar fusion were done to necessary levels.

The average follow-up is 16.3 months (8-36). Pre and postoperative VAS and ODI scores are used for assessment. Radiologic control of the patients was done using calculated Cobb's angle from standing scoliosis images and L1-S1 lumbar lordosis angles.

RESULTS:

The average hospitalization of the patients was 4.2 (3-10) days. The calculated preoperative average Cobb's angles of the patients were 22.6 (15-40) with postoperative average has fallen to 4.8 (0-10) (Figure-1,2).

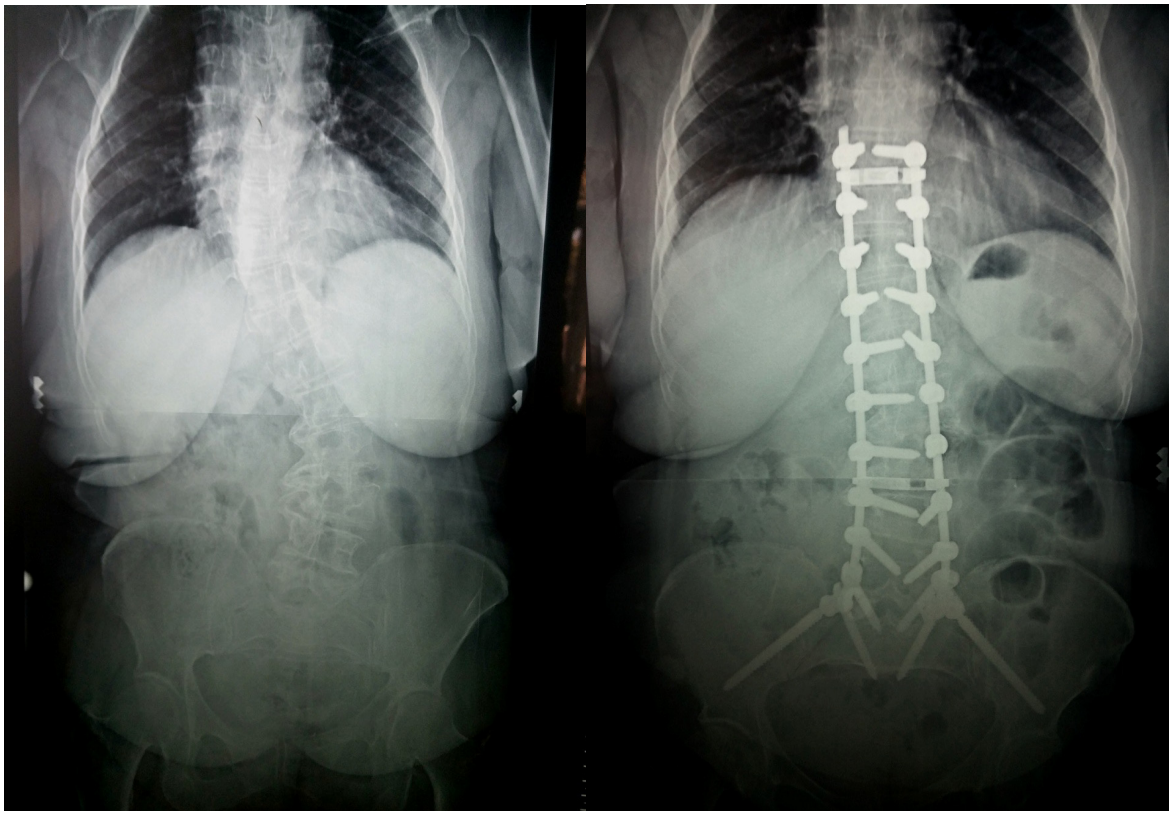

Figure-1. D8-Illiac wing instrumentation with decompression through L2-3-4 total laminectomy.

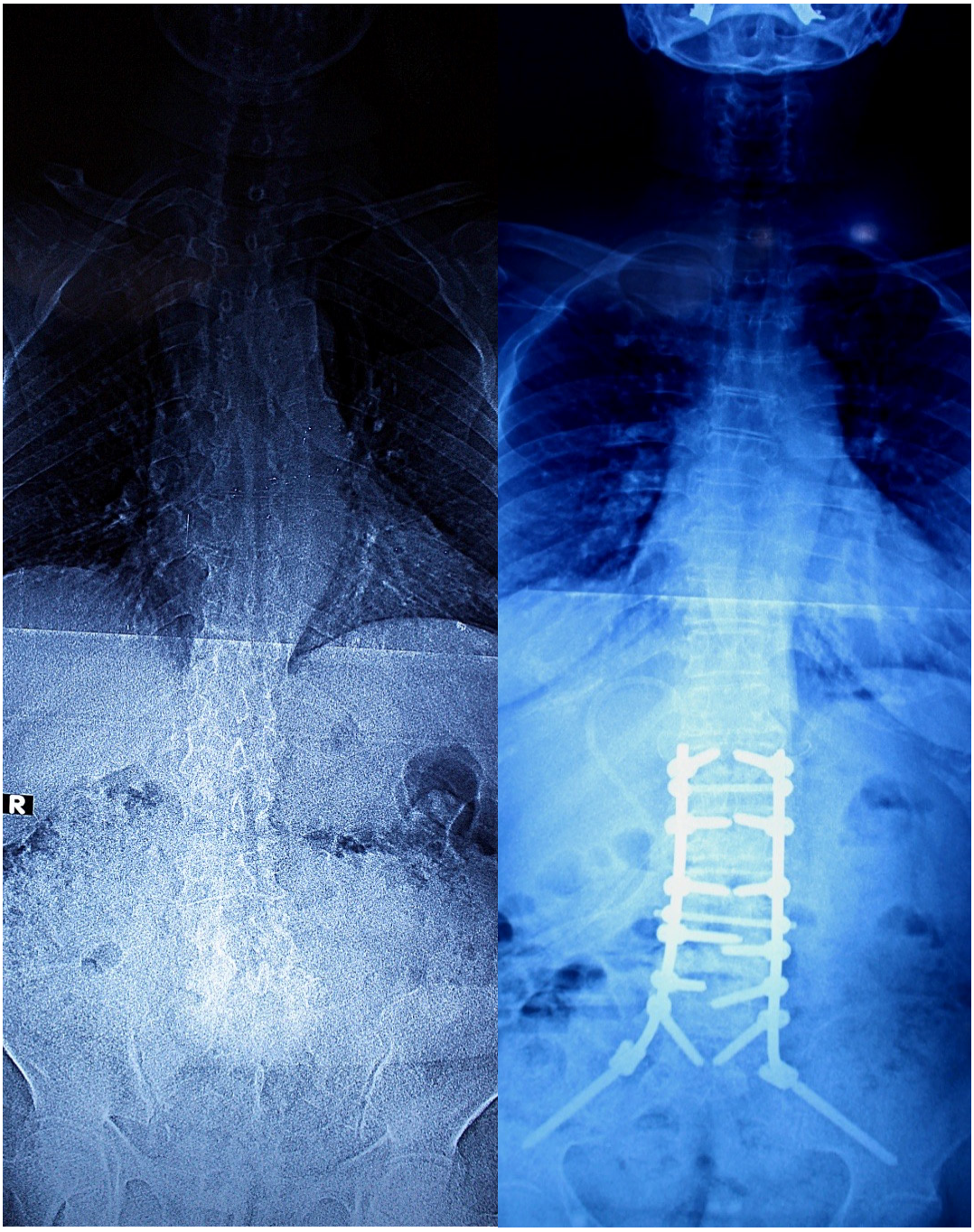

Figure-2. T12-Illiac wing instrumentation (excluding S1) with decompression L3-4-5 total laminectomy.

The preoperative average L1-S1 lumbar lordosis angle of the patients was 30.8 (15-45) and significant lordosis loss was noted. Postoperative average L1-S1 lordosis angle were calculated to be 40.3 (25-55) (Figure-3).

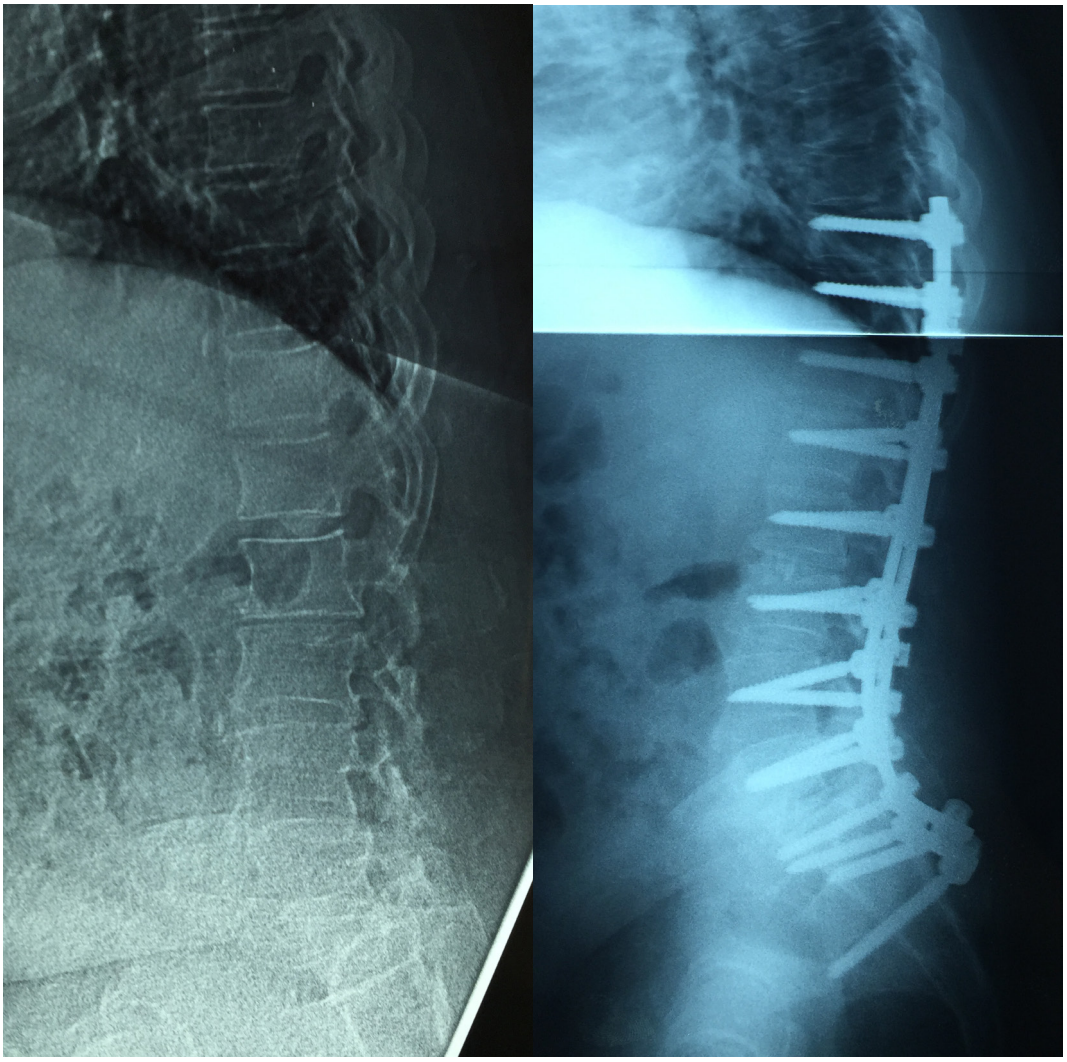

Figure-3. Sagittal preoperative and postoperative views of T10-Illiac wing instrumentation.

Preoperative average VAS was 7.8 (7-9) with the postoperative average 2.4 (0-4). Preoperative average ODI was 54 % (46-74 %) with the postoperative resulting average of 18 % (12-30 %). Postoperative complications were seen on 4 of the patients. 2 patients developed postoperative radiculopathy and frusta paralysis and had to undergo another decompression operation. 1 patient had wound infection and antibiotics were administered with the supervision of the present infectious diseases resident and the patient was discharged on 10th day with oral antibiotheraphy. Deep vein thrombosis was diagnosed on the 10th postoperative day in 1 patient and necessary treatment was administered in junction with cardiovascular surgery department.

DISCUSSION:

Surgical correction of DLS is a harder operation among the spinal deformity interventions. Because of the fact that lumbar degeneration is seen in a comparatively older part of the population, comorbidities are common. The careful analysis of the deformity is vital in operation of the DLS. Apical vertebra and the top and bottom level of the deformity should be studied. Knowing the principals of the scoliosis disease is very important for choosing the right method for the operation (9,18).

Transpedicle screw fixation is first used by Roy-Camile in the 70ies. Roy-Camile used screw fixation commonly in the treatment of fractures (20). Pedicle

screw fixation is commonly used today in many spinal cases need of strong stabilization of the posterior bodies (21). Also using pedicle fixation enables the correction of scoliosis in multiple planes.

Hurry et al. performed solo posterior or combined anterior and posterior operations for correction of the rigid lumbar scoliosis. They've come to find that posterior pedicle screw stabilization with wide posterior relaxation is as successful as correction with combined anterior and posterior approach (11). In our series, correction through posterior approach rendered successful results.

Glassman et al. find a distinctive correlation of successful treatment and correction of the balance in coronal and sagittal planes (11). In our series, we also found an agreeing correlation.

Lang et al. insisted on that Multi-segment decompression, internal fixation and fusion helps relieve the symptoms resulting from root compression and improves the life standard by helping remaintain the spinal balance. They come to the conclusion that this procedure is a viable treatment for DLS (17). We also come to the conclusion that decompression, stabilization, and deformity correction resulted in an increase of life standard and quality in out patients.

Schwab et al. reported that the bent top end plates of L3-4 vertebrae correlate with lateral malposition of the lumbar vertebrae, loss of lumbar lordosis, pain of the thoracolumbar kyphosis and general unpleasant clinical features. They agree on the fact that posterior correction is as successful as combined approach of anterior and posterior techniques (24)

Decompression of the neural components results in clinical recovery. Decompressive surgery is very effective in relief of the radicular pain but remains ineffective in mechanic back pain. Postoperative residual back pain could have been cause by mechanic origins and mostly results from spinal instability (12).

Kleinsteuck et al. comes to find that decompression and fusion approach results in better clinical recovery in patients with segmental instability compared to single decompressive surgery. In our series, our patients all had DLS with correlated segmental instability and radiological findings. Combined decompression and fusion resulted to the recovery from the symptoms (14).

DLS surgery is reported to have high complications in the literature (3,5-8,12,19,24-26,29). Kostuik and Hall (16) reported that in patients whom the sacrum was included in the fusion had 78 % complications. Simmons et al. (26) reported 41 % complications in their series of 49 patients. Swank et al. (29) reported a complication rate of 53 % in their 222 patient-series. Daubs et al. (8) reported 37 % complication rate in their 46 patient adult scoliosis series. In our series of 20 patients we had a total of 20 % complications. 2 patients developed postoperative radiculopathy and frusta paralysis and had to undergo another decompression operation. 1 patient had wound infection and antibiotics were administered with the supervision of the present infectious diseases resident and the patient was discharged on 10th day with oral antibiotheraphy. Deep vein thrombosis was diagnosed on the 10th postoperative day in 1 patient and necessary treatment was administered in junction with cardiovascular surgery department. There was no mortality or mechanical complication.

Surgical approach road can be taken when the clinical and radiological findings correlate. These findings include but not limited to the angulation of the L3 and L4 endplate angulation, loss of lumbar lordosis, thoracolumbar kyphosis and lateral listhesis (5,7,12).

Patients with adult degenerative scoliosis have symptoms consisting of back pain, neurological claudication, and imbalance in the coronal and sagittal plane. Different approaches can be taken in the treatment. 3 operative approaches can be defined in adult degenerative scoliosis. These are; only decompression, decompression and limited short fusion, and deformity correction through long segment fusion.

Only decompression is not advised since it will add to the imbalance. Limited short fusion and segmental decompression is advisable for patients with

low Cobb's angle, minimal rotational deformity and correct sagittal and coronal balance. Short fusion does not have satisfactory effect on restoration of the lumbar lordosis.

The long fusion approach is especially satisfactory for patients with high Cobb's angle and coronal and sagittal imbalance. Long fusion approach is needed for correction of the deformity.

Instrumentation, decompression and correction in LDS surgery is very successful in carefully picked patients, especially renders comparatively better results in older, osteoporotic patients whom further correction manoeuvers are planned as it will contribute to the strengthening of the spine.

Patients with adult lumbar scoliosis will have a higher risk for additional problems with the increasing age. Operations on these patients have very different hardships compared to adolescent scoliosis operations. The surgical intervention has a higher complication rating. We can achieve successful results in carefully picked patients.

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ORIGINAL ARTICLE / *ORJİNAL MAKALE*

OUR CLINICAL EXPERIENCES: THORACIC OUTLET SYNDROME

TORASİK ÇIKIŞ SENDROMU: KLİNİK DENEYİMLERİMİZ

Uzay ERDOGAN[1], Hakan KINA[1], M.Orhun ÇEVİK[1], Aykut AKPINAR[2], Erhan EMEL[1], A. Ender OFLUOGLU[1]

SUMMARY

Introduction: The compression of the brachial plexus and subclavian circulatory elements at the cervicoaxillar canal is called the thoracic outlet syndrome (TOS). Among the ethological reasons, congenital fibromuscular osseous anomalies lead the top. Electrophysiological study of the upper nerves is single most dependable diagnostic test.
Material-Method: In our clinic between the years 2008 and 2014, 10 patients were diagnosed with TOS. The average age of the patients were 46.2 (36-64), with 5 of them being women and the remaining 5 men. The average length of the symptoms was 14 months (8-36). 4 of the patients were undergone operation with transaxillary approach and the other 4 with supraclavicular approach for decompression of the brachial plexus. All of the patients were evaluated using the VAS score.
Results: Solitary scalenectomy was done on one patient, single cervical cot resection was done to 4 of the patients and both scalenectomy and cot resection was done to 3 patients. No major complications or recurrence were observed on the patients. The average preoperative VAS score of the patients were 6.3 (5-8) lowered to an average of 2.1 (1-5) after the surgical intervention.
Conclusion: The previous articles reported benefit results from both surgical and non-surgical methods. We believe that a treatment plan should be worked on for every patient starting with non-surgical treatment, going with the surgical way on recurrent cases.

Keywords: Thoracic outlet syndrome, brachial plexus, cervicoaxillary canal, ulnar nerve conduction speed, surgical decompression, supraclavicular approach.

Level of evidence: Retrospective clinical study, Level III

ÖZET

Giriş: Brakial pleksus ve subklavian damarların servikoaksiller kanalda basıya uğramasına Toraksın çıkım sendromu denilir. Etyolojik nedenlerin başında konjenital fibromuskuler ve osseöz anomaliler gelir. Üst ekstremite sinirlerinin elektrofizyolojik çalışmaları nörojenik TOS'un kanıtlanmasında tek ve en güvenilir tanı yöntemidir.
Materyal-Metot: Kliniğimizde 2008-2014 yılları arasında 10 hastaya TOS tanısı konuldu. Hastaların yaş ortalaması 46,2 (64-35), 5 kadın, 5 erkek kişiden oluşmaktaydı. Hastalarımızın hepsinin şikayeti ortalama 14 ay (8-36) idi. Hastaların hepsine supraklaviküler yaklaşım ile brakial pleksus dekompresyonu yapıldı. Hastaların hepsinin preoperative ve postoperative ağrısı VAS skoru ile değerlendirildi.
Sonuçlar: Hastalardan birine yalnızca skalenektomi, dört hastaya servikal kot rezeksiyonu ve skalenektomi, üç hastaya skalenektomi ve 1. kot rezeksiyonu yapıldı. Hastalarımızda postoperatif major komplikasyon ve rekürrens gelişmedi. Hastaların preoperatif kol ağrısı VAS skoru ortalama 6.3 (5-8), postoperatif kol ağrısı VAS skor ortalaması 2.1 (1-5) olarak değerlendirildi.
Çıkarım: Çalışmalar cerrahi olmayan ve cerrahi tedavilerin iyi sonuçlar verdiği yönünde. Tedaviye cerrahi olmayan yöntemler ile başlanabilir, inatçı vakalarda cerrahi tercih edilir.

Anahtar Kelimeler: Torasik çıkış sendromu, Brakial pleksus, sevikoaksiller kanal, unlar sinir iletim hızı, cerrahi dekompresyon, supraklaviküler yaklaşım

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III.

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INTRODUCTION :

The compression of the subclavian circulatory elements and the brachial plexus while passing the cervicoaxillary canal is called the thoracic outlet syndrome (TOS). Previously these clinical features were called; scaleneus anticus, costoclavicular syndrome, cervical rib syndrome or 1. Rib syndrome (21).

Seen around 0.3-8% throughout the whole population. Generally seen in older women. Mostly appears unilaterally. Neurological involvement is seen in 95 % of the patients (7-8,21,28-29).

Most important anatomical element in the upper thoracic exit for TOS is the cervicoaxillary canal. Before entering the upper extremity, subclavian artery and vein crosses the brachial plexus along with the branches of the brachial plexus in the cervicoaxillary canal. The first costa divides the cervicoaxillary canal into two parts (Figure-1).

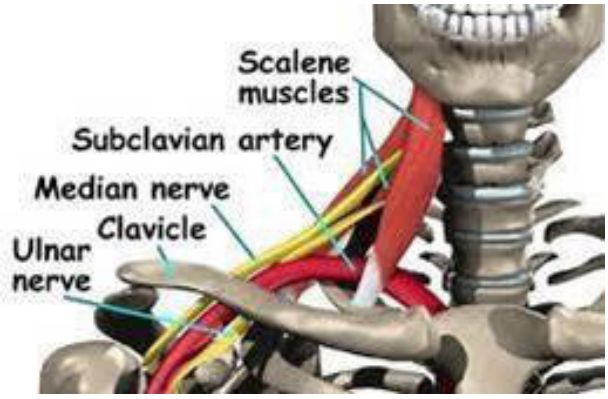

Figure-1. Cervicoaxillary canal

In the proximal section of the first costa, there is the scalene triangle and the costoclavicular space and distal to the costa lies the axillary cavity as a triangle. These three areas are the potential zones for neurological compression (6,9,20,25-26).

Among the ethological causes (Table-1) comes fibromuscular and osseous anomalies the first. Vascular pathologies are rare with the venous pathologies topping as it's highest (23).

Symptoms vary depending on the element being compressed. The symptoms can be grouped as neurological, musculoskeletal and vascular. The single most common symptom in TOS is pain. Pain can be seen in the compression of all three elements. Neurological symptoms are seen almost in all of the patients with vascular symptoms appearing in 13-46 % (14,16,20,26).

Table-1. Etiology

Soft Tissue Origin (70 %)	Skeletal Origin (30 %)
Scaleneus muscle variations	Cervical costa
Scalenous muscle hyperthrophy	C7 transvers process
Accesory scaleneus minimus muscle	Malposition in the union of first costa fracture
Abnormal ligament and bands	Fracture of the clavicle or first costa
Neoplasms of the soft tissue	Neoplasms of the osseous tissues
	Traumatic dislocations of the acromioclavicular and the sternoclavicular joint

The most affected element in TOS is the brachial plexus being consisting the neurological symptoms part. 75 % of the patients have compression of a single nerve or nerve along with a vascular element. The most common neurological symptoms are pain, paresis or muscle weakness. Pain and paresthesia seen in 95 % of the patients whereas motor symptoms are seen in 10 % of the patients.

TOS caused by trauma appears with the symptoms as pain over the trapezius muscle, pain in paravertebral and parascapular region and pain in the neck and occipital region. Pain in the head and neck are often related with sudden reflex contraction of the scalene muscles reacting to trauma. These types of pain are not common in musculoskeletal anomalies, however can be seen in anomalies caused by trauma.

Vascular symptoms arise by the compression of the subclavian artery or vein. Solitary vascular symptoms are seen less then solitary neurological symptoms. Solitary subclavian artery compression is seen in 10 % of the patients, and compression of the subclavian vein seen in 2 % of the patients (16). The compression in the upper thorax exit can remain asymptomatic during rest.

Provocative tests are used to aggravate the symptoms during physical examination. Adson or scaleneous test, costoclavicular test (army stand test), arm stress test, hyperabduction test, pressure provocation test are among the methods used. The aim of the

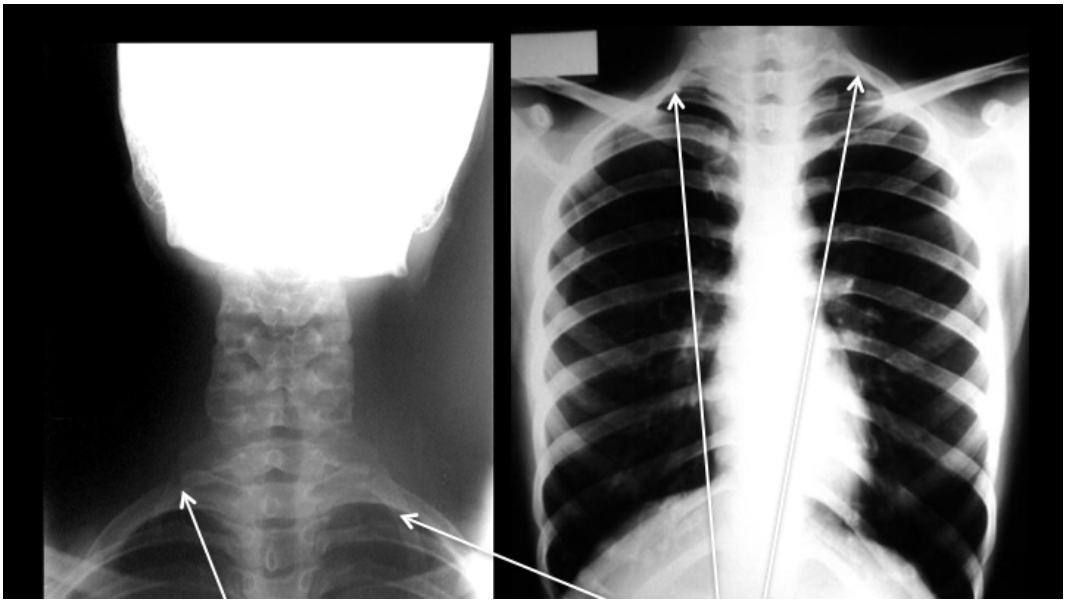

Figure-2. Cervical rib

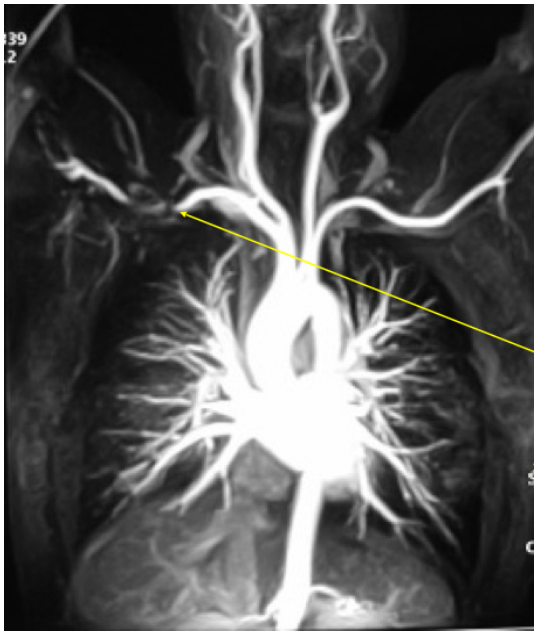

Figure-3. Subclavian artery compression at hyperabduction.

provocative tests is further increasing the compression of the cervicoaxillary canal resulting in the aggravation of the symptoms.

Different radiological imaging methods from cervical radiography (Figure-2) to magnetic resonance imaging (MRI) (Figure-3) can be used for the diagnosis. MRI is better for showing the fibrous bands or other soft tissue compressive elements (28).

The electrophysiological study of the upper extremity nerves is the single and most dependable diagnostic test for the patients that have neurological symptoms. Electromyography (EMG) is better for the differential diagnosis for TOS, cervical discopathy or carpal tunnel syndrome (16,20).

The most affected test is the ulnar nerve conduction speed (UNCV) test. Used by Caldwell first in 1971 for TOS diagnose (20). Patients with TOS have a lower speed conduction of the ulnar nerve. Normally the average conduction speed of the ulnar nerve in the

upper thoracic exit is 72m/s. Any resulting value of 70 or lower is diagnostic for TOS (20) The conduction speed of the nerve lowers depending on the compression. The average speed affected by neurogenic TOS is 32-65m/2 (9,16,20).

MATERIAL-METHOD:

In out clinic between the years 2008 and 2014, 10 patients were diagnosed with TOS. The average age of the patients were 46.2 (36-64), with 5 of them being women and the remaining 5 men. All patients had pain and paresis symptoms. The pain described throughout the patients is as a pain starting from the cervical region scattering to the arm and chest. Paresthesia was associated with C5-T1 radicles and varied throughout the patients. None of the patients had any motor deficits. None of the patients showed any vascular symptoms. The average symptom length of the patients was 14 (8-36) months. All of the patients received different lengths of medical and physical therapies.

Diagnosis was done with EMG, direct radiography of the cervical region, MRI and MR angiography. 5 of the patients were undergone operation with transaxillary approach and the other 5 with supraclavicular approach for decompression of the brachial plexus. All of the patients were evaluated using the VAS score.

RESULTS:

The average follow-up of the patients was 38 months. Patients were hospitalized for an average of 3 (2-5) days after the surgery. Solitary scalenectomy was done on one patient, only cervical rib resection was done to 5 of the patients and both scalenectomy and rib resection was done to 4 patients. No major complications or recurrences were observed on the patients. The average preoperative VAS score of the patients were 6.3 (5-8) lowered to an average of 2.1 (1-5) after the surgical intervention. It was worked out that all patients operated for TOS diagnose showed successful results.

DISCUSSION:

Patients diagnosed with TOS are first taken to undergo conservative treatment. Mild and moderate cases respond well to medical treatment. Serious cases don't respond well to the conservative approach.

Conservative treatment protocols are losing weight, painkillers, and muscle relaxers, warm compresses, correcting posture and exercise programs. Furthermore, enlightening patients about the harms of carrying weight on the shoulder, sleeping with a high pillow or sleeping with the affected side down are among the conservative treatment protocols (13).

Novak et al. reported successful results with their 42 patient series with 25 cures with conservative methods. The follow up with these patients were done for 6 months along with physiotherapy. Painkillers and muscle relaxers were prescribed and activity education was given. Also transcutaneous electrical nerve stimulation and injection methods were used (10).

Torriani et al. reported 69 % short-term clinical regression of the symptoms using conservative methods (19). Vanti et al. reported that a conservative approach is a viable treatment following their literature sweep.

The patients that cannot be treated with conservative methods, having bone pathologies, and have UNCV of a value lower than 60 m/s, are good candidates for surgical treatment. Surgical decompression methods include resection of the first rib and other bone pathologies, division of the fibrous and other soft tissue bands, division or resection of the scaleneus muscle (13,21,23). Transaxillary, supraclavicular or posterior subscapular approach can be taken in surgical intervention (27).

With the supraclavicular approach, the brachial plexus, first costa and the neurological elements can be seen better thus can be conserved better. Surgeons take this approach in neurogenic TOS for resection of the first costa and the scaleneus muscle (5). Terzis et al. reported successful results and low complication rates for the surgical treatment with this approach (18). In our series, all our patients had neurogenic TOS and 5 patients whom we used this approach had successful results and no complications.

Transaxillar approach is first described by Ross (12) in 1966. It is said that this approach is better for resection of the first costa along with the fibrous band. It is reported that this approach gives a better field of view for first costa resection (4-5). Urchel et al. in their series of experiences with patients for 50 years reported successful results with their resection of first costa and costoclavicular ligament, and neurolysis of C7, C8 and T1 branches using the transaxillary approach (24). In our series, we operated 5 of our patients using this approach with no major complications and had successful results (Figure-4).

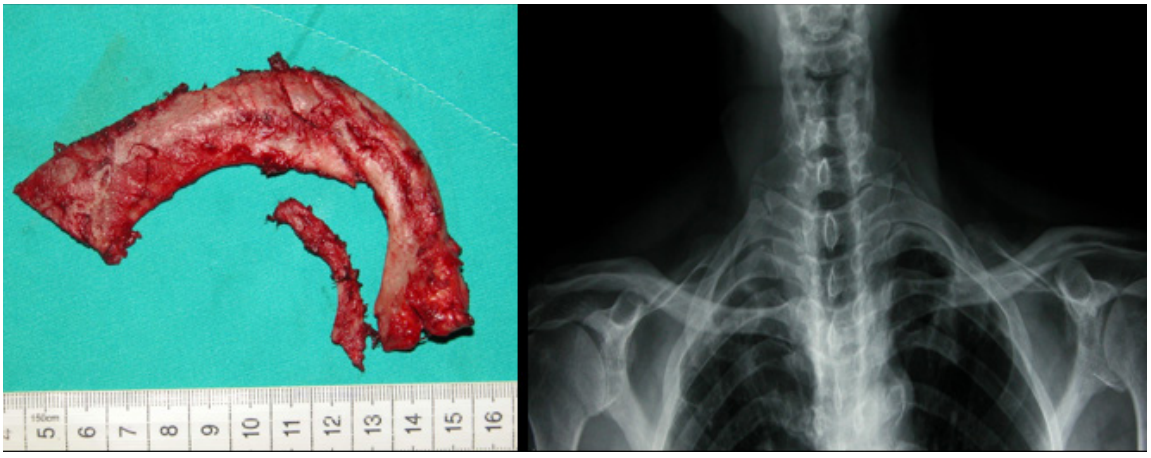

Figure-4. First rib resection with tranaxillary approach

Clagett first described posterior subclavian approach in the year of 1962 (3). It is used for the neurolysis of the proximal portion of the brachial plexus. This method is very invasive has the most complications. Urschel et al. used this method for the resection of the residual costa and neurolysis of the brachial plexus in recurrent TOS patients (24).

Depending on the reported results, the clinical success rates of supraclavicular approach is 80-85 % (6) and the transaxillary approach 80-93 % (21,23). In cases with the primary cause being the soft tissue, partial scalenectomy path can be taken. It is reported that this method is more successful and has less complications compared to the resection of the first costa method (2,11,15).

In our day, with the video guided thoracoscopic approach (VATS) thoracic sempathectomy is used for some TOS patients (1,17,22). With this approach deeper anatomical structures can be observed better.

Pneumothorax, and damage on the subclavian artery, vein, brachial plexus and thoracic duct are among the complications that can be listed. Karamustafaoglu et al. have reported an incidence of pneumothorax 25% (4). Other complications are reported much less.

TOS is a rare condition of the upper extremity which has symptoms of a wide variety and not very specific. It has been reported that both surgical and non-surgical treatments have good clinical results. Treatment can be started with a non-invasive approach and continued on with a surgical intervention on stubborn cases.

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ORIGINAL ARTICLE / *ORJİNAL MAKALE*

COCCYDINIA: PAIN MANAGEMENT WITH RADIOFREQUANCY THERMOABLATION OF GANGLION IMPAR

KOKSİDİNİ: İMPAR GANGLİONUNUN RADIOFREKANS TERMOABLASYONU İLE AĞRI TEDAVİSİ

Hüsnü SÜSLÜ[1], Murat KÖKEN[2], Selçuk ÖZDOĞAN[3], Mehmet TIRYAKI[3], Ali Haluk DÜZKALIR[4]

SUMMARY

Introduction: Coccydynia is a rare but painful condition that affects the coccygeal region. The incidence is not well known but obesity and female gender are increased risk factors for developing. The management is complicated for the clinicians due to unknown etiology with no universally accepted treatment. Our aim is to evaluate the results of radiofrequency thermoablation (RFT) of ganglion impar treatment for coccydynia.
Materials-Methods: We conducted a prospective, cross sectional study including 42 patient who suffers from coccydinia. Visual Analog Scale (VAS) and Oswestry Low Back Pain Disability Questionnaire (Oswestry) score were used to determine the progression of pain under treatment.
Results: The study included 42 patients with coccydynia. Of these 15 (% 35.7) were male and 27 (% 64,3) were female. The average body mass index(BMI) is 28,6 kg/m2 and weight 78,1kg. Men were significantly taller and heavier than women but there is no statistically difference in age, BMI, duration of pain. After six months follow-up VAS was dramatically decreased but in the first year examination, minimally increased again. Oswestry and VAS had a correlation in one year follow-up.
Conclusion: Treatment with RFA has a better clinical outcome supported with or without medical treatment when compared with medical treatment alone.

Key words: Coccydynia, Radiofrequency thermoablation, Coccydynia pain management

Level of evidence: Prospective clinical stuıdy, Level II

ÖZET

Giriş: Koksidini koksigeal bölgeyi etkileyen nadir fakat ağrılı bir durumdur. Insidansı çok iyi bilinmemekle birlikte kadın cinsiyet ve obezitenin koksidini gelişme riskini arttırdığı bilinmektedir. Etyolojisi tam olarak bilinmeyen bu ağrılı durumun tedavisinde de hekimler icin evrensel bir tedavi protokolu bulunmamaktadır. Çalışmamızın amacı koksidini tedavisinde impar gangliyonunun radyofrekans termoablasyonu (RFT) sonuçlarını incelemektir.
Materyal-Metot: Koksidini tanısı almış 42 hastanın prospektif kesitsel çalışması yürütüldü. Tedaviyi değerlendirebilmek için Visual Analog Scale(VAS) ve Oswestry Low Back Pain Disability Questionnaire (Oswestry) testleri kullanıldı.
Bulgular: Çalışmaya koksidini tanısı almış 42 hasta dahil edildi. Bunların 15 (% 35,7) erkek, 17(% 64,3) kadındı. Ortalama vücut kitle indeksi (BMI) 28,6 kg/m2 ve ağırlık 78,1 kg idi. Erkeklerin BMI kadınlardan yüksek olmasına rağmen yaş, cinsiyet ve ağrı arasında istatistiksel bir fark bulunmadı. RFT işlemi sonrası 6 aya kadar takiplerde VAS skorunda istatistiksel anlamlı azalma gözlendi. Birinci yıl sonunda VAS skorunda minimal bir artış olmasına rağmen istatistiksel olarak anlamlı değildi. Oswestry ve VAS takibinde bir yıl sonunda korelasyon mevcuttu.
Sonuç: RFT kullanımı ilaç destekli veya desteksiz olarak koksidini tedavisinde tek başına medikal tedaviden daha iyi sonuçlar vermektedir.

Anahtar kelimeler: Koksidini, Radyofrekans termoablasyon, Koksidini ağrı yönetimi

Kanıt düzeyi: Prospektif klinik çalışma, Düzey II

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INTRODUCTİON:

Coccydynia is a painful situation that will be difficult to treat and the etiologies are hard to elucidate. It was first described in 1726 as pathologic entity in the region of the coccyx. Coccydynia mainly affects women and often related to trauma, obesity, pregnancy, child birth, cancer, degenerative and idiopathic (3,11,12). Some authors attribute this to more posterior anatomical location of sacrum and coccyx (13). Coccydynia was associated with some psychiatric problems such as depression and hysteria in 80s (7).

The classic presentation of coccydynia is localized pain over the coccyx. Patients present complaining of " tailbone pain". The pain will usually be worse with prolonged sitting, leaning back while seated, prolonged standing and rising from a seated position (4). Pain may also be present with sexual intercourse or defecation.

Most cases of coccydynia resolve within weeks with conservative treatment but for a few patient the pain can become chronic. There is debate over the optimal treatment for patients with chronic coccydynia (9). Nonsurgical strategies consisting of medications such as non-steroidal anti-inflammatory agents (NSAIDs), analgesics, steroid injections, coccyx manipulations, reduced sitting, donut pillow use, postural adjustments and physical therapy (9).

Destruction of ganglion impar using radiofrequency thermoablation (RFT) is another therapeutic option. RFT is a percutaneous minimally invasive procedure. Ganglion impar has been blocked in the relief of many chronic pain syndromes originating from pelvic structures such as the coccyx. Procedure involves an electrical circuit consisting of an active electrode, tissues near the tip of the active electrode and a dispersive electrode.

The purpose of our study was to evaluate the effect of RFT of ganglion impar for chronic coccydynia patients who were not cured with conservative and medical treatments (5,8).

MATERİAL AND METHODS:

The study included 42 patients with coccydynia. Of these 35.7 % were male and 64,3 % were female. The average body mass index (BMI) is 28,6 kg/m^2 and weight 78,1kg. All 42 patients treated with RFT procedure. Nineteen patients treated with only RFT, 11 patients treated RFT+NSAIDs, twelve patients treated RFT+NSAIDs+Gabapentin (GP). All patients signed an informed consent.

All procedures were performed on the fluoroscopy table. 22G 10mm active-tip radiofrequency needles were used at 50Hz with 0,9V. Before procedures all of the patients did not respond with NSAIDs, GP, donut seat pillows and other conservative methods. Patients with radicular symptoms and rectal, gynecologic disorders were excluded.

Pre-procedure Visual Analog Scale (VAS) and Oswestry Low Back Pain Disability Questionaire (Oswestry) and post-procedure 1.,3.,6. and 12. month follow-up were documented. Data from 42 patients was used in the analysis. The covariates used were age, gender, length, weight, BMI, chronic pain period (Table-1).

Table-1. Demographics variables of all group

		n	%					
Gender	Male	15	35,7					
	Female	27	64,3					
		All		Male		Female		
		Mean	SD	Mean	SD	Mean	SD	p
Age (year)		65,3	7,5	67,3	5,7	64,1	8,2	,192
Length (cm)		165,4	8,6	172,1	7,1	161,6	7,1	<0,001
Weight(kg)		78,1	8,8	85,0	7,7	74,3	6,8	<0,001
BMI (kg/m$^{2)}$		28,6	2,3	28,7	2,6	28,5	2,3	,736
Period(month)		16,9	7,8	17,6	7,7	16,5	7,9	,671

Statistical Analysis:

For more than two groups for comparison of independent groups Kruskal-Wallis non-parametric variance analysis, the Mann-Whitney U test was used for both groups. Dependent group comparisons for more than two groups in the Friedman test, Wilcoxon test was administered to both groups. For statistically significant differences detected in more than two group comparisons were made post-hoc analysis, the Wilcoxon the groups dependent on this analysis,

the Mann-Whitney U test was used for independent samples. Pairwise comparisons based on the number of post-hoc analysis of Bonferroni correction was applied. The relationship between VAS scores and Oswestry scale study was carried out with the Spearmanno-parametric correlation analysis. Type-1 margin of error for all the main groups except for analysis post-hoc analysis was adopted as 5 %. Analysis in SPSS 21 (IBM, Inc., USA) software is used.

RESULTS:

All patients fully completed follow-up visits for one year. VAS baseline (pre-procedure) measurements of the patients, first, third, 6th and 12th months evaluated and the results obtained are presented in Table-2.

In comparisons made based on the change of VAS scores during visits. In post-hoc analysis (Table-3) significant changes that cause initial VAS values of the group, while the assessed VAS scores at follow-up was determined that it remained significantly lower compared to baseline.

In addition, VAS values higher than 3th months, 1th month, 12th month values were higher than the 3th and 6th months. Change of VAS score over time is presented graphically in Figure-1.

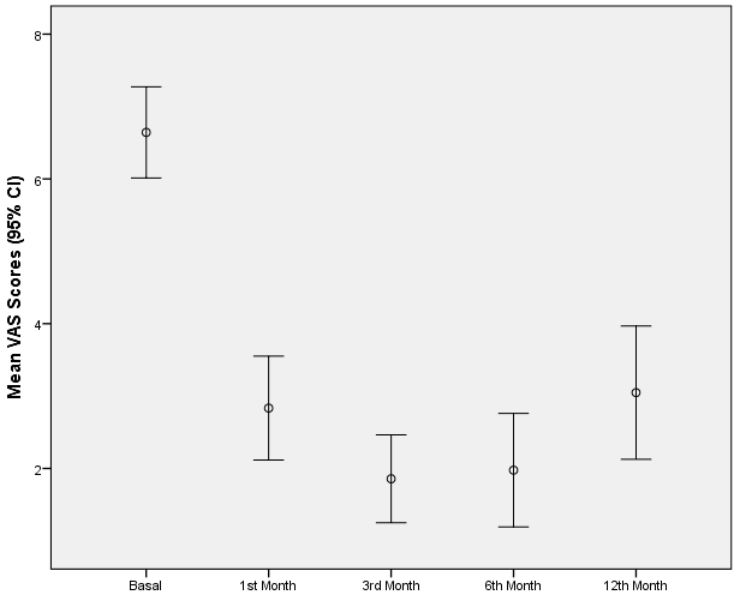

Figure-1. Change of VAS score over time

Table-2. Periodic changes of VAS

VAS	Mean	SD	median	25 percentil	75 percentil	p
0 (Pre-procedure)	6,64	2,02	6,00	5,00	8,00	
1. month	2,83	2,30	2,50	0,00	5,00	
3. month	1,86	1,95	2,00	0,00	2,00	<0,001
6.month	1,98	2,51	2,00	0,00	3,00	
12. month	3,05	2,95	2,00	0,00	4,00	

Table-3. Post-hoc significant analyses for VAS

	0 - 1 . month	0 - 3 . month	0 - 6 . month	0 - 12 . month	1 - 3 . month	1 - 6 . month	1 - 12 . month	3 - 6 . month	3 - 1 . month	6 - 12 . month
p	<0,001	<0,001	<0,001	<0,001	0,003	0,061	0,712	0,64	0,005	<0,001

VAS scores made to assess whether men and women differ between gender comparisons are presented in Table-3. According to the analysis measured at baseline and during follow-up VAS values of the patients according to sex it has been found to show a difference.

The study on the evaluation made by the treatment at baseline (p = 0.015), 3th months (p = 0.006), 6th months (p = 0.001) and in 12th months (p <0.001)

RFT+NSAIDs+GP, RFT+NSAIDs and RFT has been found to show statistically significant difference between patients' VAS (Table-5).

P values for the post-hoc analysis are summarized in Table-6.

Scores change over time in the Oswestry scale are also summarized in Table-7.

Initial assessment, first, third, 6th and 12th month compared and by time changes in a statistically significant change observed in the form of a reduction as a trend over time for this change to occur, but only 6th and 12th month measurements have been found to differ significantly (Figure-2).

Table-4. VAS scores differ between gender comparisons

	Gender				
VAS	Male		Female		
	Mean	SD	Mean	SD	p
0 (Pre-procedure)	6,87	2,17	6,52	1,97	0,680
1. month	3,2	2,48	2,63	2,22	0,495
3. month	2,07	2,22	1,74	1,81	0,749
6. month	2,47	3,09	1,7	2,15	0,584
12. month	3,2	3,03	2,96	2,97	0,767

Table-5. Comparison of procedures

VAS	Procedure						
	RFT+NSAIDs + GP		RFT+NSAIDs		RFT		
	Mean	SD	Mean	SD	Mean	SD	p
O(pre-procedure)	6,00	1,41	6,91	1,81	6,13	2,13	0,015
1. month	3,00	2,41	2,09	1,87	2,73	2,60	0,258
3. month	1,67	1,72	1,18	1,83	1,47	1,19	0,006
6. month	2,50	2,32	1,45	1,57	0,53	0,92	0,001
12. month	4,25	2,53	2,00	1,55	1,27	1,71	<0,001

Table-6. P values for the post-hoc analysis

	0(pre-procedure)	3. month	6. month	12. month
[RFT+NSAIDs+GP] - [RFT+NSAIDs]	0,196	0,401	0,273	0,025
[RFT+NSAIDs+GP] - RFT	0,98	0,831	0,013	0,003
[RFT+NSAIDs] - RFT	0,293	0,346	0,103	0,232

Table-7. Oswestry results of follow-up

Oswestry	mean	SD	median	25 percentil	75 percentil	p
0 (pre-procedure)	37,38	18,89	39,00	17,00	53,00	
1. month	27,98	15,00	30,00	14,00	35,00	
3. month	20,67	13,35	19,00	10,00	29,00	<0,001
6. month	15,48	11,85	11,50	7,00	19,00	
12. month	14,95	15,81	10,00	5,00	16,00	

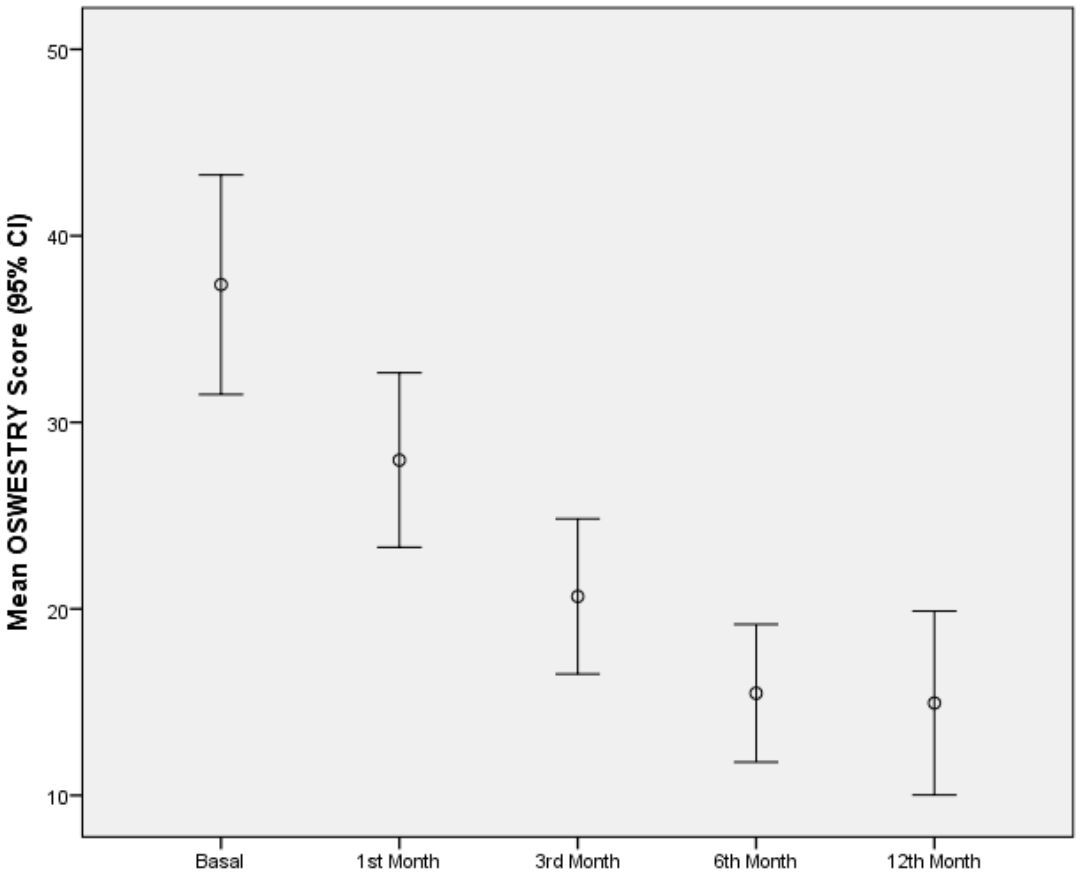

Figure-2. Change of Oswestry score over time

The measurement results obtained with Oswestry scale compared between male and female patients are summarized in Table-8. There is no statistically difference in gender for Oswestry score change in time.

By comparing the treatment scores obtained with Oswestry scale by drugs. It has been found to differ between groups of the values obtained at all measurement points (Table-9).

Post-hoc analysis are summarized in Table-10, substantially surgery was found to be significantly higher than the score of the patients.

Correlation of Oswestry and VAS scores assessed in this study are summarized in Table-11.

According to the analysis of only Oswestry in the initial assessment and VAS scores were correlated statistically, first month measurements of mild ($r = 0.323$; $p = 0.037$), third months measurement of mild-to-moderate ($r = 0.476$; $p = 0.001$), 6^{th} months measurement of medium-strong degree ($r = 0.643$; $p < 0.001$) and 12^{th} months if the measure strong degree ($r = 0.709$; $p < 0.001$) and all the correlations were positive (the rising of Oswestry scores in parallel with the increase in VAS scores).

When the results are evaluated it is clear that RFT procedure is beneficial for the treatment of chronic pain of coccydynia. Only 4 of 42 patients have gone for surgery. All 38 patients benefit from RFT procedures with or without NSAIDs and GP, however they have not been cured with only medical and conservative treatment modalities.

Table-8. Oswestry results according to gender

Oswestry	Gender				
	Male		Female		
	Mean	SD	Mean	SD	p
0 (pre-procedure)	34,33	21,65	39,07	17,38	0,365
1. month	25,47	18,51	29,37	12,83	0,232
3. month	20,47	17,1	20,78	11,11	0,470
6. month	15,07	13,08	15,7	11,36	0,703
12. month	14,67	18,88	15,11	14,21	0,422

Table-9. Oswestry results

Procedure							
Oswestry	RFT+NSAIDs+GP		RFT+NSAIDs		RFT		p
	Mean	SD	Mean	SD	Mean	SD	
0 (pre-procedure)	32,58	21,26	29,73	16,76	40,60	14,58	0,032
1. month	24,00	14,96	22,73	13,76	28,93	10,78	0,037
3. month	18,92	12,76	13,64	9,16	20,60	8,45	0,010
6. month	15,42	12,41	9,45	5,16	13,07	6,47	0,008
12. month	13,58	15,06	8,18	5,40	10,87	5,28	0,010

Table-10. Post-hoc analysis

	0 (pre-procedure)	1. month	3. month	6. month	12. month
[RFT+NSAIDs+GP] - [RFT+NSAIDs]	0,622	0,758	0,355	0,308	0,664
[RFT+NSAIDs+GP] - RFT	0,232	0,271	0,464	0,941	0,509
[RFT+NSAIDs] - RFT	0,102	0,169	0,04	0,131	0,221

Table-11. The correlation between VAS scores and Oswestry scale

	Oswestry 0(pre-procedure)	Oswestry 1. month	Oswestry 3. month	Oswestry 6. month	Oswestry 12. month
	r (p)	r (p)	r (p)	r (p)	r (p)
VAS 0 (pre-procedure)	0,124 (0,435)	0,132 (0,403)	0,268 (0,086)	0,337 (0,029)	0,391 (0,01)
VAS 1. month	0,314 (0,043)	0,323 (0,037	0,305 (0,05)	0,243 (0,121)	0,188 (0,233)
VAS 3. month	0,325 (0,035)	0,389 (0,011)	0,476 (0,001)	0,526 (<0,001)	0,536 (<0,001)
VAS 6. month	0,268 (0,086)	0,323 (0,037	0,461 (0,002)	0,643 (<0,001)	0,676 (<0,001)
VAS 12. month	0,156 (0,323)	0,201 (0,202)	0,388 (0,001)	0,59 (<0,001)	0,709 (<0,001)

DISCUSSION:

Coccydynia is a rare condition that is often self-limited and mild. Although it usually responds well to conservative treatment, some patients require more aggressive treatments (1). Minimal invasive procedures and conservative methods such as analgesics, non-steroidal anti-inflammatory agents (NSAIDs), local anesthetics, steroid injections, coccyx manipulations, reduced sitting, donut pillow use, postural adjustments, physical therapy and nerve blockage techniques (9). Coccygectomy may be indicated for patients who have failed conservative management.

A randomized open study showed that intra-rectal manipulation had a 25% success rate in treating chronic coccydynia(6). Steroid injections under fluoroscopic guidance into the coccygeal joints have shown better efficacy with patients suffering from acute coccygeal pain.

RFT is a percutaneous minimally invasive procedure. Various RFT techniques have been used for intervertebral discogenic pain. The ganglion impar is the lowest ganglion of the paravertebral sympathetic chain, which is placed at the anterior aspect of the sacrococcygeal disc. It has been blocked in the relief of many chronic pain syndromes originating from pelvic structures such as the coccyx. RFT involves an electrical circuit consisting of an active electrode, tissues near the tip of the active electrode and a dispersive electrode. We performed at 50 Hz, and reproduction of pain at less than 0.9 V. There is no universal consensus.

There are few studies for the use of RFT of ganglion impar in the literature. Demirçay et al. aimed to evaluate the effectiveness of RFT of ganglion impar in patients with chronic coccydynia using the parameters of pain and health related quality of life and they reported success. Also Foye et al. and Reig et al. inspected the use of RFT of ganglion impar nerve blocks with some success(2,10) Our study results are supporting these studies.

Finally our results support that RFT of ganglion impar may provide beneficial pain relief in the treatment of chronic coccydynia. RFT is minimal invasive, simple to perform and relatively safe procedure that should be suggested in chronic coccydynia patients who are unresponsive to conservative treatment modalities.

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CASE REPORT / *OLGU SUNUMU*

DYSPHAGIA CAUSED BY ANTERIOR CERVICAL HYPEROSTOSIS: CASE REPORT

ANTERIOR SERVIKAL HIPEROSTEOZUN NEDEN OLDUĞU DISFAJI: OLGU SUNUMU

Selçuk ÖZDOĞAN[1], Hakan SABUNCUOĞLU[2],
Güçlü Kaan BERİAT[3], Mehmet TİRYAKİ[1], Ali Haluk DÜZKALIR[4]

SUMMARY

The anterior cervical hyperosteophytosis is observed even in 20-30% among healthy people and may be a direct cause of dysphagia. Dysphagia is reported to be the most common symptomatic presentation that refers to a difficulty in the whole or part of swallowing. Diagnosis must be made by laryngoscopic examination because usually the lesion may not be large enough to be seen with oropharyngeal examination. In our case the patient suffer from dysphagia, was treated surgically through removal of the hyperostosis with the transoral approach. Surgical removal of the osteophyte was performed and the patient was relieved from symptoms.

Key words: Dysphagia, Hyperostosis, Cervical osteophyte

Level of Evidence: Case report, Level IV

ÖZET

Anterior servikal hiperosteofitik oluşumlar sağlıklı insanlar arasında % 20-30 oranında görülebilmekte ve disfajiye neden olabilmektedir. Disfaji, tüm yutma semptomlarındaki en sık semptomolarak belirtilmiştir. Tanısında mutlaka laringoskopik muayene yapılmalıdır çünkü rutin orofarinks muayenesi ile görülemeyebilir. Olgu sunumumuzda disfaji şikayeti olan hasta transoral cerrahi yöntemi ile ameliyat edildi ve hiperosteotik kemik çıkartıldı. Osteofitik parçanın çıkarılmasının ardından hadtanın semptomu kalmadı.

Anahtar kelimeler: Disfaji, Hiperosteoz, Servikal osteofit

Kanıt Düzeyi: Olgu sunumu, Düzey IV

INTRODUCTION:

Anterior cervical hyperosteotic spurs of the anterior cervical spine may occur in 20% to 30% of the population (2). Utsinger et al. reported that the symptoms arising from cervical osteophytosis, dysphagia is developed at a ratio of 17 % (14). Generally cervical osteophytes are asymptomatic but they may lead to symptoms such as dyspnea, cough, dysphagia and dysphonia (3,7,10-11). Mosher et al. first described 2 patients with dysphagia caused by large anterior cervical osteophytes in 1926 (9). The anterior cervical osteophytosis is observed even in 20-30% among healthy people and may be a direct cause of dysphagia (1).

Dysphagia is reported to be the most common symptomatic presentation that refers to a difficulty in the whole or part of swallowing. This disorder occurs in the oral, pharyngeal and esophageal phases which leads to a disorder of function where food in the oral cavity is transferred to the gastrointestinal tract (6). Diagnosis must be made by laryngoscopic examination because usually the lesion may not be large enough to be seen with oropharyngeal examination (8).

Large anterior cervical osteophytes are associated with idiopathic skeletal hyperostosis (DISH), posttraumatic osteophytogenesis, senile degenerative skeletal disease, cervical spondylitis, infectious spondylitis and ankylosing spondylitis (1,4,12,15). We reported an Idiopathic skeletal anterior cervical hiperosteosis case with the only symptom of dysphagia.

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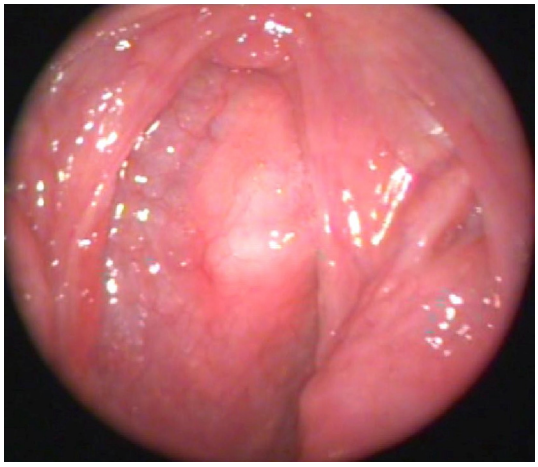

Figure-1. Laryngoscopic view of the lesion

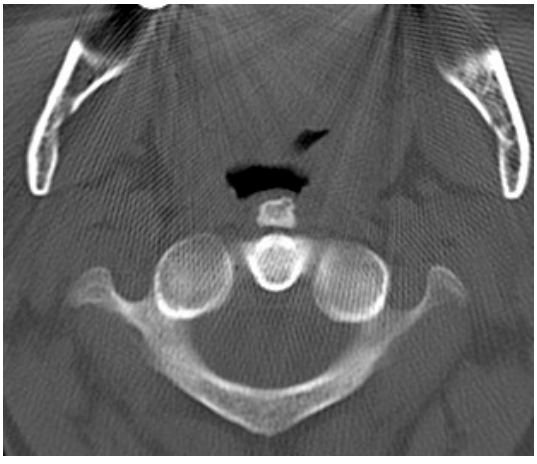

Figure-2. Computed Tomography axial image of lesion

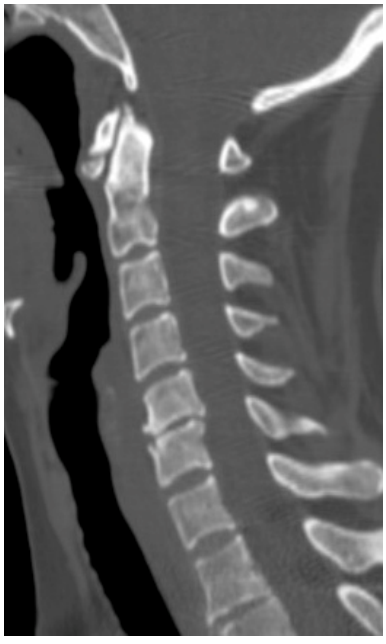

Figure-3. Computed Tomography axial image of lesion

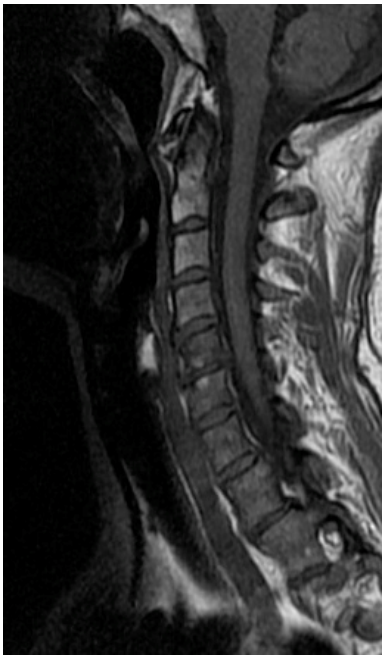

Figure-4. Magnetic Resonance Image sagittal view of the lesion

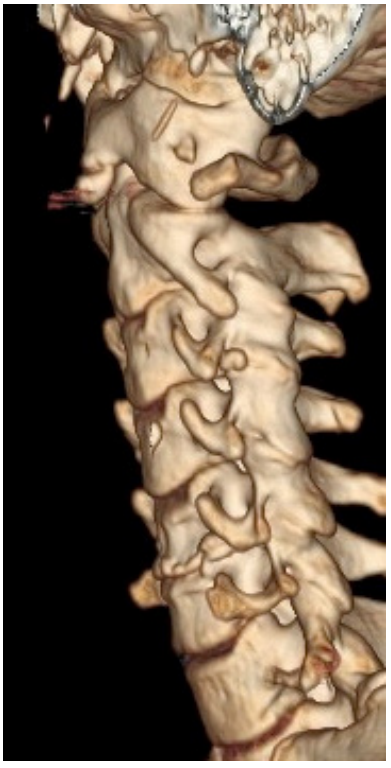

Figure-5. 3D reconstruction by Osirix ®

CASE REPORT:

Patient that suffers from dysphagia applied to Ear-Nose-Throat (ENT) department. After a detailed oropharyngeal examination has been made, a swollen lesion was detected at pharynx. Then laryngoscopic examination was made to identify the lesion clearly (Figure-1).

Patient had been consulted to neurosurgery clinic. Computed tomography(CT) and magnetic resonance imaging(MRI) showed lesion in details (Figure-2,3,4). 3D reconstruction of CT was made by Osirix® (Figure-5).

Transoral surgery was recommended to remove the lesion to the patient. Uvula hanged upwards to make the lesion visible on transoral approach. Special Boyle Ecarteur applied to the mouth to reach the lesion. After the incision to the soft tissue the lesion was appeared. High speed drill used to remove the osteophyte. Dysphagia disappeared after the surgery.

DISCUSSION:

Osteophytes of the anterior cervical spine are common in elderly patients and are usually asymptomatic. They may shrink the pharynx or esophagus and can cause dysphagia, dyspnea or stridor. Hyperosteophytosis of the cervical vertebrae may cause dysphasia with mechanisms such as mechanical pressure on esophagus, inflammation and edema on periphery, cricopharyngeal spasm and abnormal recurvation of epiglottis (5). It may cause complications, including aspiration pneumonia, bronchospasm, dehydration, malnutrition and suffocation in severe cases (4).

Diagnostic investigation should include laryngoscopic examination in fact the lesion may not be large enough to be seen with oropharyngeal examination (8). A lateral plain radiograph can be helpful to evaluate the cervical spine. CT or MRI with sagittal reconstruction is advised to mark the location of anterior bony lesions in relation to the surrounding tissues. Barium swallow test can also be used to exclude neoplasm as well as reveal compression and obstruction of the esophagus. We used CT and MRI in this case. Alternative causes of dysphagia must be considered including neurologic disease (Parkinson disease, stroke amyotrophic lateral sclerosis) and/or mechanical obstruction due to neoplasms, mediastinal masses, the Zenker diverticulum, esophagus webs and stricture or cancer of the esophagus (15,17).

Treatment is conservative or surgical. Conservative treatment is antibiotics, anti-inflammatory agents, steroids and muscle relaxants (8). There are many surgical techniques, including anterolateral, posterolateral, and transoral approaches (13,16-17). In our case the patient was treated surgically through removal of the hyperostosis with the transoral approach. Surgical removal of the osteophyte was performed, and the patient was relieved from symptoms.

The therapeutic approaches considered for dysphagia include medication to reduce inflammation and edema around the cervical vertebrae, and a surgical treatment to restore the movement of epiglottis by correcting the anatomical compression and deformity of cervical vertebrae.

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REVIEW ARTICLE */ DERLEME*

THE USE OF VIDEO ASSISTED THORACOSCOPIC SURGERY IN SPINAL DEFORMITY CORRECTION

VİDEO YARDIMLI TORAKOSKOPİK CERRAHİNİN SPİNAL DEFORMİTE DÜZELTİLMESİNDE KULLANIMI

H. Yener ERKEN[1], Mehmet Nuri ERDEM[2]

SUMMARY

Video-assisted thoracoscopic surgery has become an alternative treatment option for various spinal disorders in recent years. A thoracoscopic approach minimizes chest wall morbidity that is more commonly seen in traditional thoracotomy. Existing indications for video-assisted thoracoscopic surgery are the same as those of any traditional open anterior spinal surgery. Since, posterior surgery has advanced significantly over the past 20 years with the routine use of thoracic pedicle screws, posterior releases and apical rotation maneuvers, video-assisted thoracoscopic surgery has lost its popularity and is therefore rarely used today. The purpose of this article is to review video-assisted thoracoscopic surgery options in spinal deformity correction.

Keywords: Spinal deformity, video assisted thoracoscopic surgery

Level of evidence: Review article, Level V.

ÖZET

Geçtiğimiz yıllarda video yardımlı torakoskopik cerrahi birçok spinal problem için geçerli bir seçenek haline gelmiştir. Torakoskopik yaklaşım, geleneksel torakotomide oluşan göğüs duvarı hasarını en aza indirir. Video yardımlı torakoskopik cerrahi endikasyonları geleneksel açık anterior spinal cerrahi endikasyonları ile aynıdır. Son 20 yılda posterior cerrahi, torasik pedikül vidalarının, posterior gevşetmelerin ve apikal rotasyon manevralarının rutin kullanımı ile belirgin olarak gelişmiştir. Bu nedenle video yardımlı torakoskopik cerrahi popülaritesini kaybetmiş ve bugün nadiren uygulanmaktadır. Bu makale spinal deformitelerin düzeltilmesinde video yardımlı torakoskopik cerrahi seçeneklerini derlemek amacıyla yazılmıştır.

Anahtar Kelimeler: Spinal Deformite, Video yardımlı torakoskopik cerrahi

Kanıt Düzeyi: Derleme, Düzey V.

INTRODUCTION:

The first report of thoracoscopic surgery was in 1910, after Jacobaeus used thoracoscopy to release tuberculosis lung adhesions. Although video-assisted thoracoscopic surgery (VATS) has been widely used in thoracic surgery since the early 1980's, it became popular in spine surgery in the 2000's. In literature, there are several reports about the advantages of VATS over traditional open thoracotomy in the treatment of spinal conditions. These reports show that patients had less postoperative pain and decreased narcotic requirements. Shoulder girdle function improved faster than open surgery due to less dissection of the latissimus dorsi, serratus anterior and intercostal muscles (1,6,16,26-29,34,38). Patients also had shorter intensive care unit and hospital stay, decreased postoperative pain, improved patient satisfaction, superior cosmesis and better pulmonary function recovery (21,34,35).

VATS was first used for thoracoscopic anterior release (TAR), combined with posterior spinal fusion and instrumentation (PSFI) for treatment of severe curves and young patients who had a risk of crankshaft phenomenon (27,29,38). As VATS technology advanced and surgical experiences grew, the indications for VATS expanded. Today, the indications of VATS in spine surgery include: treatment of thoracic disc diseases, tumor excision, fracture treatment, osteomyelitis, and draining intervertebral disc space abscess, thoracic vertebral inter-body fusion, and thoracoscopic anterior spinal fusion and instrumentation (TASFI) for spinal deformity correction (2,8,9,15,17,21,23,24,31,33).

VATS may be most beneficial in scoliosis surgery. In scoliosis, there is a need to access multiple vertebrae and intervertebral discs, from the upper to the lower thoracic spine. However, in thoracic disc disease and spinal infection, the pathology is limited

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to a local area and a mini-open thoracotomy can be used instead. In scoliosis surgery, multiple portals in the lateral chest wall provide unrestricted access to the thoracic vertebrae and disc spaces from T4 to L1 level (21).

The appropriate candidate for the TASFI procedure is an AIS patient with a right side thoracic (Lenke type 1) curve less than 80 degrees with a thoracic kyphosis less than 40 degrees. Although VATS is generally recommended for patients between 30 and 70 kilograms weight, Early et al. reported successful outcomes in children under 30 kilograms. However, they emphasized that very small patients (under 20 kg) should remain a relative contraindication to TASFI, especially during a surgeon's learning curve (6).

The primary disadvantage of TASFI is that it is technically demanding, has a steep learning curve, and requires special training and experience. The use of this technique has declined significantly because of increased surgical times, the technical difficulty, the delay in returning to preoperative athletic activities and issues related to safely placing anterior screws with the close proximity of the aorta on the contralateral spine (1,28,32,33). Because of these factors, this procedure is rarely utilized today. Because of the proven efficacy and familiarity, PSFI has become the mainstay of spinal deformity surgery.

TECHNICAL ASPECTS:

A fiber optic camera and a light source is used in VATS for visualization and magnification through small multiple portals. The goal is to address the pathology with minimal injury to adjacent tissues. This approach offers direct lighting and 15 times magnification of the area. By changing the position of the thoracoscope, scope angle and camera route, VATS permit a clear visualization of the thoracic spine from T1 to T12 (21). Before performing a VATS, the surgeon should be aware of the surgical anatomy, anesthetic necessities, patient positioning and the endoscopic techniques to warrant an ideal surgical outcome. The majority of the VATS approach for spinal pathology is from the right side where there is a greater working spinal surface area lateral to the azygos vein compared to the aorta. A left-sided approach below the T9 is more possible because the aorta has moved away from the left posterolateral aspect of the spine to an anterior position (21).

Spinal levels may be determined during thoracoscopic surgery by locating the superior intercostal vein emptying into the superior azygos vein at the T3-4 interspace and by identifying the diaphragmatic insertion at the vertebrae in the caudal aspect. The T12 vertebra and the T12-L1 disc space may be found by using the anatomic landmarks of the diaphragm. Eventually, disc levels may be identified by taking an intra-operative radiograph to localize an intervertebral disc marked by a Steinman pin.

ANESTHESIA AND POSITIONING CONSIDERATIONS:

Routine testing of preoperative pulmonary function is advocated to select the appropriate approach for a patient with a thoracic scoliosis. The patients with scoliosis may have significant preoperative pulmonary morbidity besides the postsurgical decline in pulmonary function. It is important to determine the impact of the surgical approach on pulmonary function in order to choose the appropriate approach for the patient (7).

TAR and TASFI have been performed traditionally in lateral decubitus position with single-lung ventilation. The lateral position with single-lung ventilation requires repositioning and re-intubation for the posterior surgery. This increases the operative time and the morbidity of the procedure. Single-lung ventilation can lead to significant complications secondary to high air-way pressures and ventilation-perfusion mismatches that cause the "down lung syndrome" (32,34-35).

As a solution to some of the difficulties of the lateral position, some authors have described performing a TAR in the prone position (14,20,35). Traditionally, in the lateral position a double-lumen endotracheal tube is used to deflate the ipsilateral lung. Prone positioning eliminates this need and double lung ventilation is used with decreased tidal volumes. Gravity helps in the retraction of the lung and eliminates the postoperative pulmonary issues seen with single lung ventilation (34). Since, a TAR procedure can be performed with double lung ventilation in the prone position, the detrimental effects on pulmonary functions will be less than those seen in the single-lung ventilation (14,20,35).

PRONE POSITION THORACOSCOPIC ANTERIOR RELEASE (TAR) TECHNIQUE:

''The patient is positioned in the prone position. A regular single lumen endotracheal tube is generally used to achieve double-lung ventilation. After prone positioning of the patient, the anesthesiologist lowers the tidal volumes from the usual levels (8-10cc/kg) by approximately 30 % to 50 % while increasing the respiratory rate as tolerated by the patient. This provides for some lung deflation and easier access to the spine. The thoracoscopic portals are placed in a linear fashion usually in the posterior axillary line. The initial

portal was placed so that it was approximately at the apex of the curve and a 30 degree 10-mm diameter thoracoscope is then placed through the existing portal. When initially placing the thoracoscope, the lens is directed posteriorly to find the space between the lung and the posterior chest wall. The thoracoscope is then directed over the top of the lung to visualize the spine, and the ribs are counted from proximal to distal to identify the levels to be released/ fused based on the preoperative plan. The remaining portals are placed under direct visualization using the thoracoscope. Typically, four portals are created and held the camera, a suction tube, a lung retractor, and a working instrument. Following placement of all portals, the pleura is incised in the midvertebral body level leaving the segmental vessels intact. The pleura is then bluntly dissected anteriorly to expose the entire anterior longitudinal ligament (ALL) with exposure of the annulus on the contralateral side and dissected posteriorly to identify the rib heads. The annulus and ALL are incised with a #15 scalpel blade, and the annulus and nucleus are disrupted with endoscopic disc shavers manually rotated within the disc space. Currettes and rongeurs are then used to remove the disc and endplate material and autologous bone or allograft are placed. The parietal pleura is closed with a running 2-0 absorbable suture, using the Endostitch device. Two running sutures are placed, one from distal to proximal and one proximal to distal, and tied in the center. Following pleural closure, the chest is cleared of debris and irrigated with normal saline. A chest tube is placed through the distal portal skin incision tunneled to the adjacent pleural entrance and secured to the skin with a suture" (35) (Figure 1).

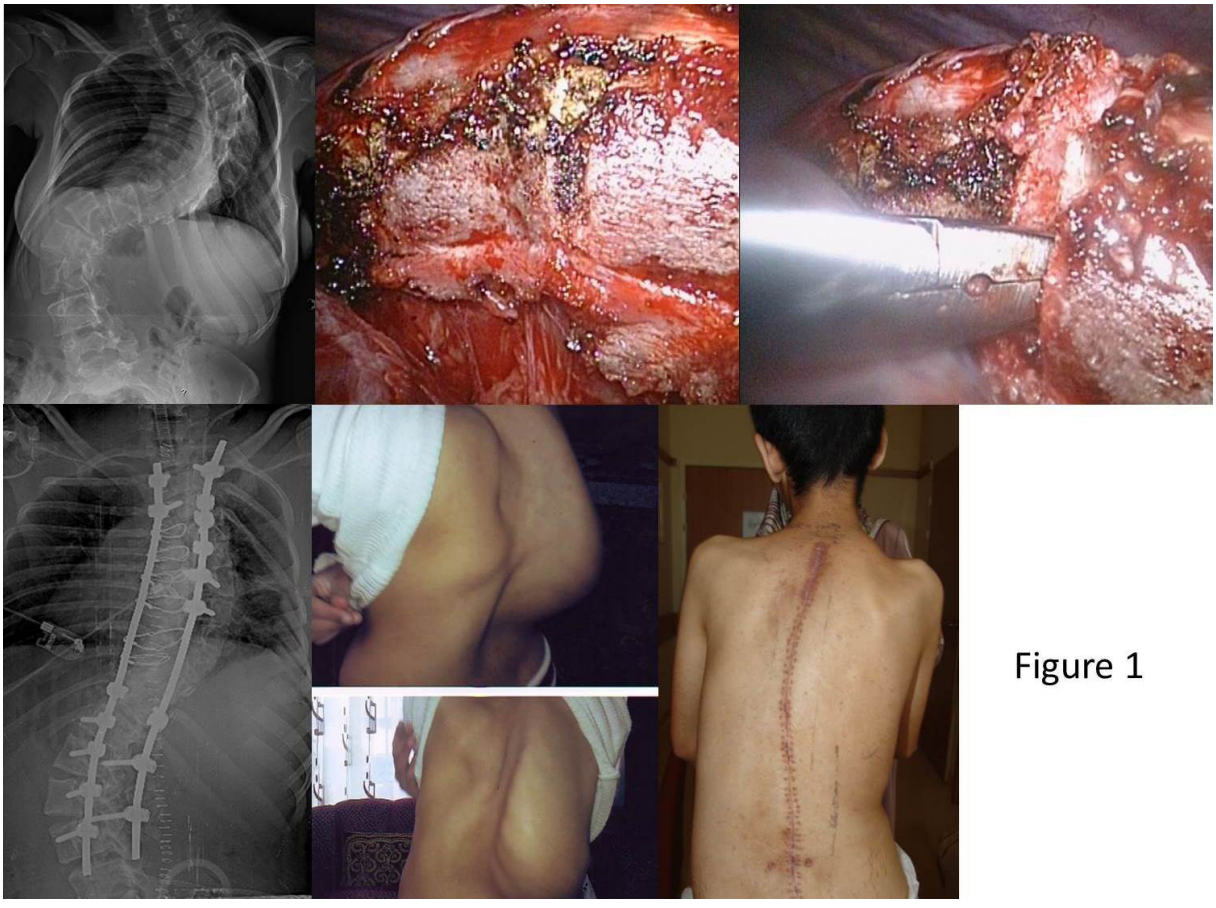

Figure-1. A very severe and stiff double major curve with a marked coronal imbalance and apical rotation in a 14 year old girl. TAR, intraoperative halo-femoral traction and PSFI is used to achieve a balanced spine.

THORACOSCOPIC ANTERIOR SPINAL FUSION AND INSTRUMENTATION (TASFI) TECHNIQUE:

In order to perform TASFI, the lung on the convexity of the curve must be deflated. This is accomplished with a double-lumen endotracheal tube. Patients are positioned in the lateral decubitus position on a radiolucent operating table with the convexity of the curve up. The first port (12 mm) is placed at the apex of the curve in the anterior-to-midaxillary line and the thoracoscope is then placed through this portal. The thoracoscope consists of a camera and a scope that is angled at 30 or 45 degrees. The posterolateral portals are created under direct visualization. For the placement of the most cephalad portal the skin mark made under fluoroscopic visulation is used to place a guide pin, which is assessed using the camera in the anterolateral portal. The remaining posterolateral portals are then placed with careful attention to the distances between portals and their positions in the anteroposterior direction. Positioning is assessed with the thoracoscope in the anterior portal to ensure that the portals are made directly over the vertebral bodies. After incising the pleura in the midvertebral body, the segmental vessels is coagulated. The pleura is bluntly dissected posteriorly of the rib heads and anteriorly around the front of the spine to allow access to the anterior longitudinal ligament and contralateral annulus. Sharp incisons of the disk are made with a scalpel blade or a harmonic scalpel. Disk shavers, rongeurs, and curettes are used to excise the disk as completely as possible. Autologous iliac crest or allograft are used for grafting immediately upon completion of the discectomy at each level. Bone funnels are used to place the grafts. Before screws are placed, the patient's position is re-checked to ensure it is straight and lateral. The thoracoscope is placed in the anterior portal initially to direct the guide wire with respect to the superoinferior starting point and orientation. The thoracoscope is then moved to a posterolateral portal to check the anteroposterior starting point and its direction. Screws are placed beginning at the apex of the curve, with the starting point of the screw just anterior to the rib head. The screws are directed slightly anteriorly to avoid the spinal canal and to be in the midaxial plane of the rotated apical vertebral bodies. A single skin incision is used to place the screws 2 or 3 intercostal spaces to ensure optimal instrument alignment for screw placement. After all of the screws have been placed and checked fluoroscopically, the rod is measured, cut and inserted through the distal or proximal posterolateral portal and grasped within the chest with a rod grabber so that it could be seated into the screws in one step. The rod initially should be seated distally to help control the length of rod that protrudes distal to the screw and prevent it from pushing against the diaphragm. After compression and cantilever maneuvers are performed and the rod is captured in the proximal screw heads, compression is applied and screws are serially tightened. After coronal and sagittal correction and screw position are confirmed using fluoroscopy, the pleural incision is closed and the hemi-thorax is irrigated. A single chest tube is placed through one of the inferior portals and all incisions are closed in layers.

DISCUSSION:

Surgical treatment of scoliosis has changed rapidly in the last 20 years and still continues to improve. PSFI with pedicle screws, hooks and sublaminar wires was an improvement to the Harrington instrumentation because it developed correction in the coronal and sagittal planes. It allowed for an earlier return to daily activities, with overall improvement in spinal deformity correction. Posterior surgery has advanced with the routine use of thoracic pedicle screws, posterior releases and apical rotation maneuvers which has resulted in improved correction of the three-dimensional deformity. PSFI is performed routinely in most spine centers and offers stable fusion levels, good sagittal control and beneficial effects on pulmonary function, allowance to ambulate without postoperative bracing and low pseudoarthrosis rates (19,30,39).

Conversely, anterior spinal instrumentation and fusion is still a valid option for patients with thoracic curves. Deciding the surgical approach (posterior vs. anterior route) is based on the curve type, amount of correction desired, the number of motion levels to be fused, and the surgeon's experience (3,4,18). Anterior instrumentation for thoracic adolescent idiopathic scoliosis (AIS) reached its peak in popularity in the late 1990's and early 2000's while offering comparable coronal plane correction with improved restoration of thoracic kyphosis and saving distal motion segments (3). The anterior approach offers a mechanical advantage since the corrective force is applied at the greatest distance from the center of the curve and screws placed in the vertebral body have a 30% greater moment arm for applying corrective forces than posterior hooks (3,11,22). This procedure traditionally requires a thoracotomy, which has an approach-related morbidity to pulmonary functions (13). Additionally, the anterior procedure provides less rigid bony fixation, greater incidence of loss of fixation, implant-related failure and nonunion compared to PSFI (3,4,18).

With the advances in VATS, TASFI became popular in spine surgery in the 2000's. This technique minimizes numerous disadvantages of the open anterior thoracic approach. It provides improved cosmesis due to smaller incisions and less surgical scars, improved pulmonary function, and less postoperative pain associated with limited chest wall disruption. One of the disadvantages of VATS is the steep learning curve. The learning curve of VATS has been reported in several studies to have an influence on operating time (34). The drawbacks of VATS are the technical difficulties including clear visualization, disc space access, doubts about the completeness of disc excision and the long surgical times (21). Since this procedure is technically demanding, the incidence of complications can be high, especially in the surgeon's initial surgeries due to his lack of experience. Complications include blood vessel injury, lymphatic injury with resultant chylothorax, guide-pin migration into the opposite side of the chest with resultant pneumothorax (32).

An anterior release of the thoracic spine in combination with PSFI has traditionally been recommended for large (>70 degrees Cobb measurements) and stiff (less than 50 % flexibility index) curves, those that have thoracic hyper-kyphosis, or thoracic lordosis, and for skeletally immature patients who are at risk for the crankshaft phenomenon. Today, a posterior three-column fixation with pedicle screws is the gold standard in spinal deformity correction (19,30,39). The use of pedicle screws provide a greater coronal and axial plane correction. Hence, the threshold to perform an anterior release is higher and only the most severe curves require an anterior release. Furthermore, there is early evidence that three-column fixation of the thoracic spine prevents the crankshaft phenomenon and may preclude the need of anterior fusion in young patients (3-4,18,19,30,32,35,39) .TAR for spinal deformity correction has several proposed advantages over the more traditional open thoracotomy while achieving similar results with respect to completion of discectomy and release of the spine (10,25). This technique has traditionally been performed with the patient in the lateral position and requires single lung ventilation which results in significant physiologic stresses to the patient. These stresses include creating high airway pressures and barotrauma to the ventilated lung as well as air leakage or bronchial rupture or pneumothorax (36). This can be exacerbated by the weight of the mediastinum on the lung/bronchial tree and ventilation-perfusion mismatches can occur because the upper lung is being perfused but not ventilated, which can lead to difficulty in maintaining adequate oxygenation (5,12,37). The lateral decubitus position with single-lung ventilation requires the patient to be repositioned for posterior surgery, most often with reintubation with a single lumen endotracheal tube after removal of the double lumen endotracheal tube, re-prepping with a sterile scrub, and sterile draping (34).

As a solution to the potential problems of the lateral decubitus position, some authors have recommended using the prone position when performing a TAR (14,20,35). King et al. (14) reported 27 patients who were placed in the prone position using a standard single lumen endotracheal lumen, gaining entrance with a Veress needle and insufflation with a 4 mm Hg CO2. Leiberman et al. (20) reported 15 adult patients who had a prone anterior release and fusion using a double lumen endotracheal tube to obtain single-lung ventilation. Sucato and Elerson (34) introduced the concept of performing TAR in the prone position while ventilating both lungs and demonstrated significantly less pulmonary complications with this technique (0 % vs 14.8 %). Sucato's technique is utilized with a single lumen endotracheal tube which permits double-lung ventilation without the use of CO2 insufflation. The tidal volumes are decreased by approximately 30 % to 50 %, which is well tolerated by the patient and allows the lungs to fall away from the spine due to gravity. This provides for excellent visualization of the spine and faster operative time. In another study, Sucato et al. (35) also showed that there is no detrimental effect on pulmonary function when a prone TAR using double lung ventilation is added to a PSFI.

In conclusion, VATS in spinal deformity correction has several advantages over traditional open thoracotomy including less postoperative pain, faster improvement in shoulder girdle function, shorter intensive care unit and overall hospital stay, decreased postoperative pain, improved patient satisfaction, superior cosmesis, and better pulmonary function recovery. VATS provides a safe and effective alternative approach to spine surgery. Since, posterior surgery has advanced significantly over the past 20 years with the routine use of thoracic pedicle screws, posterior releases and apical rotation maneuvers, VATS has lost its popularity and is therefore rarely used today.

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REVIEW ARTICLE */ DERLEME*

FAILED BACK SURGERY SYNDROME

BAŞARISIZ BEL CERRAHİSİ SENDROMU

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SUMMARY

Failed back surgery syndrome (FBSS) is a chronic pain condition after one or more spine surgery. Despite advances in surgical technology, the rates of failed back surgery have not declined.This conditions are may occur in the preoperative, intraoperative, and postoperative periods. Furthermore, it is likely that multiple factors (biological, psychological, and social) are involved with the development of the pain process, necessitating an interdisciplinary approach to management. Neurosurgeons, physiotherapist, algologiest, orthopedic surgeons and radiologists are necessary to evaluate these patients as a multidisciplinary team. FBSS is a common and significant social and economic burden and lead to greater economic and physical losses compared with other chronic low back pain.

Key words: Failed back surgery syndrome, Chronic low back pain, Low back pain management

Level of evidence: Review article, Level V

ÖZET

Başarısız bel cerrahisi sendromu bir veya daha fazla omurga cerrahisi geçirdiği halde geçmeyen kronik ağrı durumudur. Cerrahi teknolojilerin gelişmesine rağmen başarısız bel cerrahisi oranı azalmamıştır.Ağrının oluşmasında birçok faktör(biyolojik, psikolojik ve sosyal) rol almakta ve çoklu disiplinyaklaşımı yönetimde tercih edilmelidir. Bu multidisipliner yaklaşımda beyin cerrahı, fizyoterapist, algolog, ortopedist ve radyologların birlikte çalışmalarına ihtiyaç vardır. Başarısız bel cerrahisi sendromu diğer bel ağrısı sebeplerine göre sosyal ve ekonomik yönden daha büyük kayıplara neden olmaktadır.

Anahtar kelimeler: Başarısız bel cerrahisi sendromu, Kronik bel ağrısı, Bel ağrısı yönetimi

Kanıt Düzeyi: Derleme, Düzey V

INTRODUCTION:

Failed back surgery syndrome (FBSS) occurs following one or more previous spinal surgeries, persistent or recurring chronic low back pain syndrome with radiculopathy or without radiculopathy. The increase in the rate of low back pain due to failed back surgery is parallel to the increase in the number of spinal surgery in recent years. The incidence of patients that will develop FBSS following lumbar spinal surgery is commonly quoted in the range of 10 % to 40 % (13,14,17,27).

FBSS with the proportion of patients varies according to the approach of surgeons in many countries. FBSS is difficult to compare rates because of differences in pain scores (4). When compared with other surgical procedures performed for nonlife-threatening conditions success rates for spinal surgery are poor. Age range have not been detected in patients with FBSS but women are apart as the gender ratio (9).

The annual cost for medical therapy for patients with FBSS, excluding further surgery or implantation of a spinal cord stimulator or intrathecal pump, is estimated to be $18,883 per patient in the United States (6). FBSS is a common and significant social and economic burden and lead to greater economic and physical losses compared with other chronic low back pain. The importance of prevention and potential methods by which to achieve this will be discussed.

ETIOLOGY:

It has been found that a strong predictive value of preoperative psychological conditions like anxiety and depression (3). However, itself chronic pain, anxi-

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ety disorder, and should even be noted that cause depression. Litigation and workers' compensation, has an important place. More than 4 revision surgery patients spend 50 % more at risk for spinal instability. Repeated surgery is associated with reduced success rates (15).

Perioperative factors are; inadequate intake of lateral recess, the screw malposition, Incorrect level of surgery, inability to achieve the aim of surgery. Posteratif period, the patients are from recent disc herniation, spondylolisthesis, epidural fibrosis (tethering effect, jeopardizing nutrition, and vascular supply to nerve root) , surgical complications (e.g., nerve injury, infection, and hematoma) and myofascial pain development causes pain. Missed level as in case of segmentation abnormalities or marked obesity, failure to perform adequate decompression as in misdiagnosis of canal stenosis during discectomy, conjoined nerve root or missed disc fragment and far lateral disc (18). Epidural fibrosis, arachnoiditis are the most common causes of pain in long term period. Between 6 % and 8 % of patients in the epidural fibrosis, arachnoiditis is seen in 16 to 12 % (26). Foraminal stenosis in FBSS is structurally the most common cause. Due to loss of disc height range "up - down" as it may be stenosis depending on the formation of osteophytes facet hypertrophy and "front-to-rear stenosis" it can also be seen (20).

After discectomy and laminectomy instability frequency can be up to 18 %. Fusion of transition zon can cause syndrome. Degenerative changes in other words the level of fusion adjacent motion segments can be seen. Fusion of failure is the most common complication rates of 5-40 % with pseudoarthrosis development. In patients with intervertebral fusion cages, it is difficult to prove that the union. To improve the pain for 6 months after surgery, the preoperative deterioration of foraminal stenosis and radiolucent appearance key around the cage. After spinal fusion with pedicle screw sudden leg pain can be caused by screws (20). When postoperative pain after a period of pain or a new pain occurs when the patient and physician repeat as wrong to evaluate it as the FBSS.

In patients with late stage the emergence of a new pathological symptoms is usually different from the reasons mentioned first operation. In this group, before connecting operations have undergone the cause of complaints should be investigated whether a new pathology. Sometimes, underlying diseases such as osteoarthritis, patients, depending on the speed of this process depends on the progression of a disease or surgery may become symptomatic.

DIAGNOSIS:

Diagnosis of chronic low back pain is multifactorial causes It can be difficult. FBSS is more difficult to diagnose. .Because non-organic factors can also cause pain. Should be a detailed history and a thorough physical examination should be performed. Many schemes have been developed to classify failed back surgery syndrome (2).

History, on the road to diagnosis is very important. Symptoms should be known well before surgery and how it is applied in a surgical subject it is a different importance. The patient's pain, what should be questioned to occur until after the surgery. Only if there is pain in the lumbar region and whether it is accompanied by radiculopathy in addition to a different importance psychosocial status of the patient should be decisive information. The level of satisfaction regarding the business, financial gain low level of education, should be questioned whether the heavy workload. secondary gain issues must be clarified. If the patient's trigger point is palpated it is determined. Muscle weakness in the preoperative and postoperative, should be carefully examined and should be noted. Smoking patients must be questioned. For determination of patients with instability in flexion-extension radiographs can be quite valuable.

In FBSS patients; leukocyte count, erythrocyte sedimentation rate, CRP, procalcitonine and other inflammatory markers, should be examined. Performed by diagnostic injections; facet, sacroiliac, radiculopathy may be distinguished. Minnesota Multiphasic Personality Inventory test, although not FBSS had a specific test can be used in case of suspicion (25).

In addition, instrument dysfunction, pseudoarthrosis, fractures and dislocation also recognizable in direct radiography. In cases where there is insufficient direct radiography, computed tomography moderate cost, helps as a non-invasive test. Epidural fibrosis, infection, disc herniation, pseudomeningocele, arachnoiditis, spinal stenosis, foraminal stenosis and neoplastic conditions must also be selected modality magnetic resonance imaging (MRI). In terms of diagnostic nuclear medicine modalities to help it is limited. 2 years after an operation conducted fusion, still it may be interpreted as increased involvement pseudoarthrosis matter if localized (10).

CONSERVATIVE TREATMENT:

FBSS treatment remains a challenge for pain medicine and the criteria for operating in cases of persistent pain are less clear. There are some conservative treatment modalities (Table-1) before giving surgery decision. It has been demonstrated that sciatica improves within 3 months with conservative medical management in 75 % of patients (23).

Table-1: Conservative Treatments for FBSS

Conservative Treatments for FBSS
Pharmacological: _ Acetaminophen _ Nonsteroidal anti-inflammatory drugs _ Cyclooxygenase-2 inhibitors _ Tramadol _ Muscle relaxants _ Antidepressants _ Gabapentinoids _ Opioids
Physical: _ Exercise therapy/physical therapy _ Spinal manipulation (chiropractor) _ Massage _ Acupuncture _ Transcutaneous electrical nerve stimulation
Psychological therapy and educational: _ Cognitive behavioral/rehabilitative therapy

There were several studies with pharmacological trials in FBSS. With regards to opioids, there appears to be an initial impact on pain intensity but over time this improvement diminishes and doses appear to escalate, furthermore no positive impact on function or other measures health status occur (7). Multi-modal analgesia does appear to be of benefit, however specific agents that demonstrate efficacy are challenging to identify, essentially, it remains difficult to isolate the appropriate agents that should make up this cocktail. Gabapentinoids may be limited by loss of effect and better understanding their role and importance in a poly-analgesic approach (8). The role of local anesthetics is limited based on the data. Myelo-relaxants is not well elucidated in the literature. Although limited cases series demonstrate improvement in patients receiving vitamin D supplementation, it remains unclear whether this is efficacious in treating underlying relative hypovitaminosis or directly in the treatment of FBSS (24).

Rehabilitative outcomes are difficult to assess, as they appear successful as a part of an overall interdisciplinary point of view (11). There is a dearth of well-delineated, targeted dynamic protocols in the literature, most studies fail to describe key elements of the rehabilitative approach in favor of generic terminology, however, the benefits of rehabilitation may not be limited to improved pain scores and may extend to functional improvement and self perceived health status and mood (7). Alternative therapies, such as chiropractic, manipulation and laser acupuncture currently do not have enough supportive literature to endorse their use.

Cognitive/behavioral therapy (CBT) is broadly defined as interventions that apply psychological principles to change the overt behavior, thoughts, or feelings of persons with chronic pain to help them experience less distress and enjoy more satisfying and productive daily lives (7). The concept of CBT was originally pro-posed to explain the continuation of a depressed mood state, which resulted from the triad of negative views about oneself, the world and the future.

MINIMAL INVASIVE METHODS:

Determining when to operate on a back pain patient is a major point of contention in the scientific literature. The problem must be aware of the epidemiology of biological and psychological. Treatment for failed back surgery syndrome should be tailored

to each patient. It is clearly indicated in those suffering from progressive motor loss or cauda equina syndrome, but in less severe cases the decision process can be difficult (19). The general consensus in surgical circles is to allow minimal invasive treatment modalities (Table-2) prior to even considering invasive surgery.

Table-2: Minimal Invasive Techniques for FBSS

Minimal Invasive Techniques for FBSS
Selective nerve root blocks
Lumbar provocation discography
Lumbar facet joint nerve blocks
Sacroiliac intraarticular injections
Caudal, interlaminar, and transforaminal epidural injections
Therapeutic facet joint conventional radiofrequency and pulsed radiofrequency
Conventional radiofrequency neurotomy
Lumbar percutaneous adhesiolysis, epiduroscopy
Intradiscal electrothermal therapy and biaculoplasty
automated percutaneous lumbar discectomy
percutaneous lumbar laser disc decompression
nucleoplasty

To investigate leg pain or low back and leg pain associated with or without FBSS, transforaminal root sleeve injections, lumbar sympathetic blocks and spinal cord stimulation testing may be essential diagnostic tools and frequently determine the treatment. It has also been shown that patients who failed to obtain sustained relief of radicular pain following the block were less likely to benefit from subsequent surgical intervention (21). Therapeutic approaches to leg pain are closely related to their underlying mechanism. Leg pain arising for low back pathology can be either inflammatory or neuropathic.

Epidural steroid injection is probably the most frequent procedure performed to treat radicular pain. Technique is simple, and safe. Neurological damage after the procedure, infection may occur. Epidural steroid injections are done studies showing that bone mineral density worsen. transforaminal, interlaminar or caudal epidural spaces are applicable. The current literature provides moderate evidence of transforaminal epidural injections in the preoperative evaluation of patients with negative or non-conclusive imaging studies, but with clinical findings of root irritation.

For chronic low back pain without disc herniation or radiculitis, the precision diagnostic blocks applied include lumbar facet joint nerve blocks, lumbar provocation discography, and sacroiliac joint blocks, and to a lesser extent, lumbosacral selective nerve root blocks or transforaminal epidural injections in the diagnosis of difficult radicular pain syndromes. FBSS is treated based on diagnosis with various modalities including epidural injections, percutaneous adhesiolysis, intradiscal therapy or annular thermal therapy, and mechanical disc decompression for disc-related pain, either discogenic or secondary to disc herniation, radiculitis, spinal stenosis, or post surgery syndrome. Facet joint interventions and sacroiliac joint interventions are utilized in managing facet joint and sacroiliac joint pain.

SURGICAL TREATMENT:

The low back pain population includes a wide variety of patients. Not all patients should go through such diagnostic processes and treatments (Table-3). Invasive treatment will be required for only a small portion of these patients.

Table-3: Surgical Treatments for FBSS

Surgical Treatments for FBSS
Spinal cord stimulation
Intrathecal drug delivery systems
Revision surgery

Spinal cord stimulation (SCS) with a low voltage electric current supplied to the spinal cord is intended to block pain signals to the brain is one of the most popular procedures for pain in recent years.. At the end of the trial period of 3 weeks after the electrodes attached to the patient; Contact the extent to which complaints, changes in analgesic treatment needs, the impact of pain on sleep patterns, changes in everyday life capacity is questioned (22). Studies have shown that, when performed with appropriate indications and accurate surgical technique, FBSS patients with decreased pain, as a significant rise in the functional capacity was shown to be the most sig-

nificant advantages of conventional medical therapy (12).

The argument that electrical stimulation of large fibers would close the gate to input from the smaller diameter and unmyelinated A-delta and C fibers mediating pain was determinant to the success of SCS. Another aspect to be emphasized stimulation of the spinal cord; protection of patients is repeated surgical procedures.

Considering that SCS is an end stage technique used in patients in whom everything has failed, SCS is an effective treatment, particularly considering the low complication rate (16) . SCS; as an effective pain relieving treatment for chronic back and leg pain in patients with or without a prior history of back surgery and presenting as predominantly leg pain. Randomized controlled trials are needed to confirm the effectiveness and cost-effectiveness of SCS in the chronic back and leg pain population with predominant low back pain and examine patient and technology-related factors that may be predictive of SCS success (22).

In the current state of evidence, intrathecal infusion devices can only be recommended in patients where all other viable options have failed. Patients for this mode of analgesia should have undergone all medically appropriate treatments, including oral opioid therapy with dose escalation (5). If the patient experiences inadequate analgesia or intolerable side effects, they may be a candidate for a trial of intrathecal administration. It is important that the patient experiences an analgesic response to opioids as opioid resistant pain is unlikely to respond to intrathecal administration (6). Patients should undergo psychological evaluation before implantation (5). After these criteria are satisfied, then a trial may be initiated. If there is a positive response to the trial, then implantation of the intrathecal pump may then be performed.

In the absence of high-quality trials to guide us, the decision for further surgery is similar to indications for the index surgery (2). If there is any significant major neurologic deficit amenable to surgery, then surgery should proceed. In the case of FBSS, if there is evidence that increased pain is due to problems with hardware, such as a pedicle screw impinging on a nerve root, corrective surgery would be indicated (1). The decision to reoperate in the remaining cases with ongoing pain is difficult. However, a small prospective study suggests that with proper patient selection, correct diagnosis, and indicated surgical procedure targeted at the pain generator, successful outcome as measured by > 50 % pain reduction and reduction in Oswestry Disability Questionnaire score is in the region of 90 % (5,8).

The management of FBSS is challenging. After reviewing the indication and technical aspects of the original surgery, the lesion that was treated surgically may not have been the cause of the patient's pain. An intensive work-up is needed to detect the source of the residual pain. Additional intervention may be justified in the case of pathology amenable to surgical correction. Fusion must be performed strictly because previous surgery failed, and should not be systematically considered after failed decompressive procedures. Finally, surgeons should collaborate with pain physicians in the management of patients with FBSS.

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REVIEW ARTICLE */ DERLEME*

COMPLICATIONS OF THE PERCUTANEOUS VERTEBROPLASTY

PERKÜTAN VERTEBROPLASTİ KOMPLİKASYONLARI

Ali Haluk DÜZKALIR[1], Selçuk ÖZDOĞAN[2], Mehmet TİRYAKİ[2], Alptekin GÜL[3], Cumhur Kaan YALTIRIK[4], Murat KÖKEN[5]

SUMMARY

Percutaneous vertebroplasty (PV) has long been applied in the treatment of osteoporotic vertebral fractures, malignant vertebral fractures and hemangiomas. Low complication rates, reduced length of hospitalization, favorable results, cost effectiveness and quiet easy application compared with conventional stabilization methods make PV first choice in suitable indications. Although it is a minimally invasive interventional technique, it is not free of severe complications. Like other interventional procedures, PV must be managed carefully. Here, we reviewed mild, moderate and dreaded complications of PV.

Key words: Percutaneous vertebroplasty, Vertebroplasty complications, Vertebral Cement Complications

Level of evidence: Review article, Level V

ÖZET

Perkutanöz vertebroplasti (PV) osteoporotik vertebra fraktürleri, malign vertebra fraktürleri ve hemanjiomların tedavisinde uzun zamandır uygulanmaktadır. Düşük komplikasyon oranları, hastanede yatış süresinde azalma, yüz güldürücü sonuçlar, maliyet etkinliği ve geleneksel stabilizasyon yöntemleri ile kıyaslandığında daha kolay uygulanabilir olması PV'yi uygun endikasyonların varlığında ilk tercih haline getirmektedir. PV her ne kadar minimal invaziv bir girişimsel işlem olsa da, ciddi komplikasyonlar da görülebilir. Diğer tüm girişimsel işlemler gibi PV de dikkatle yönetilmelidir. Bu yazıda PV'nin ılımlı, orta düzey ve en korkulan komplikasyonları gözden geçirilmiştir.

Anahtar kelimeler: Perkütan vertebroplasti, Vertebroplasti komplikasyonları, Vertebra sement komplikasyonları

Kanıt Düzeyi: Derleme, Düzey V

INTRODUCTION:

Percutaneous vertebroplasty (PV) has been accepted as safe and effective in the management of osteoporotic vertebral fractures, malignant vertebral fractures and hemangiomas. Low complication rates, reduced length of hospitalization, favorable results, cost effectiveness and quiet easy application compared with conventional stabilization methods make percutaneous vertebroplasty first choice in suitable indications. Although it is a minimally invasive interventional technique, it is not free of severe complications.

The aim of PV is to strengthen and stabilize the fractured vertebral body and pain reduction as a result. PV is usually applied to the thoracic and lumbar spine. Cervical and cervico-thoracic junction applications are rare (18, 19). The technique has been developed and spreaded quickly in the last 10 years. PV was first used by Galibert et al. in 1987 for a C2 hemangioma (10). First series were reported by Cotten et al. in 1996 and Jensen et al. in 1997 (7,13). However, as for the other interventional operations, anatomy of adjacent structures need to be mastered and whole procedure should be handled carefully to avoid unexpected complications. Also, a qualified fluoroscopy that provides detailed images of the spine and an experienced technician is essential. Although most of the complications are easy to manage, occasionally troublesome results which are difficult to treat may occur.

COMPLICATIONS RELATED TO POLYMETHYLMETHACRYLATE EXTRAVASATION:

Polymethylmethacrylate (PMMA) extravasation is a frequent and usually easy to manage complication of vertebroplasty. Cement extravasation is the main

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cause of clinical complications. It has been reported in 38 % to 72,5 % of cases with malignant fractures, and in 30 % to 65 % of cases with osteoporotic fractures (5,7,13,26). PMMA may leak into a large variety of anatomical compartments including the needle track, paravertebral soft tissue in 6 % to 52,5 % of the cases, spinal canal in up to 37,5 % of the cases, into the vertebral disc in 5 % to 25 % of the cases, paravertebral veins in 5 % to 16,6 % of the cases and epidural veins in 16,5 % of the cases (4,7,8,23). Also extravasation to metameric artery, inferior vena cava, aorta and lungs have been reported (18,26).

Cement leakage in the paravertebral soft tissue is rarely symptomatic. However, 2 cases of transitory femoral neuropathy related to PMMA leakage into the psoas muscle (Figure-1) have been reported (7, 23). Vertebral body has a round shape, thus the needle may pass anterior cortex even the tip of the needle seems to be posterior to anterior cortex on both AP and lateral images.

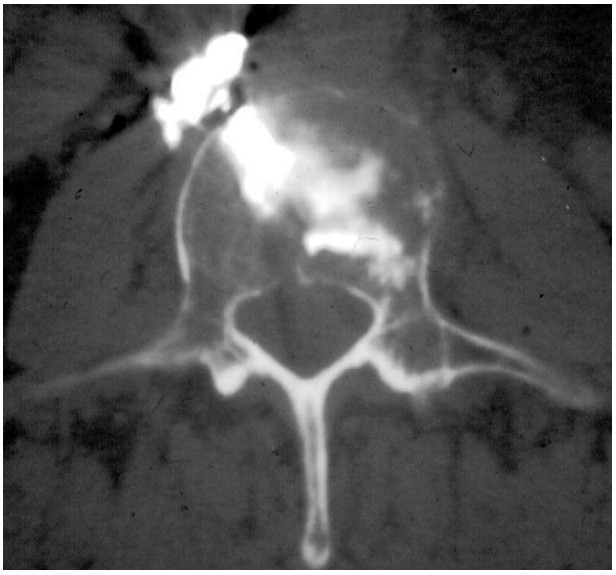

Figure-1. CT scan postvertebroplasty of a vertebral fracture of L3 due to metastatic disease: Cement extravasation in the prevertebral soft tissue.

Cement leakage into the spinal canal in case of posterior cortical destruction is more frequent. In some cases with a mass (malignancy or aggressive hemangioma) in the posterior vertebral body or anterior spinal canal, cement may fill in the mass. Therefore a leakage into the spinal canal can be seen in postoperative CT images. Such extravasations are usually well tolerated unless significant compression on spinal cord have been occured (Figure-2).

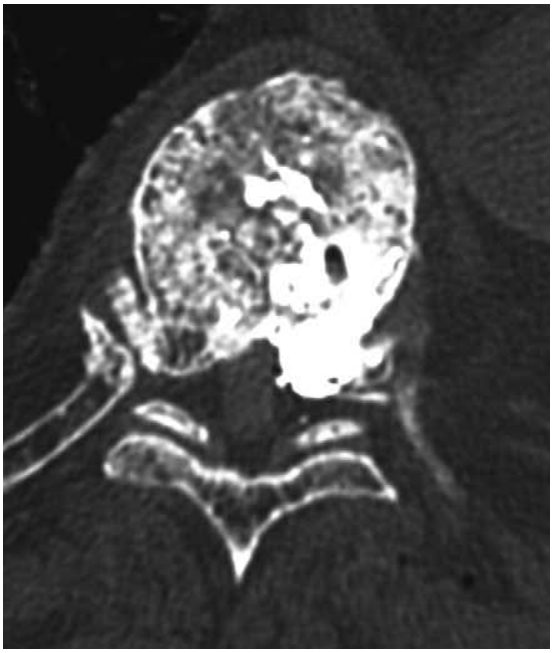

Figure-2. A multiple myeloma vertebral fracture of T7. CT scan control after vertebroplasty showing cement leakage into the epidural space.

Paraplegia is one of the most dreaded complications of PV. Fortunately it is uncommon. Chiras and Deramond reported only 1 case (0,4 %) with paraplegia after PV in 274 patients (4). This case occurred in metastatic disease and the neurologic deficit partially recovered after surgical decompression.

Since the transpedicular approach is preferred to the posterolateral approach, foraminal cement leakage is less frequent. However, an iatrogenic destruction in the medial or inferior margins of the pedicle during the PV process, foraminal and/or spinal canal cement leakage may occur (Figure-3). Nerve root compression occurs in 2 % to 8 % of the patients (7). Cement leakage in the spinal canal is apparently well tolerated than in a narrow foramen. Cotten et al. reported 15 cases of spinal canal leakage and all without any clinical symptoms, whereas 2 of 8 cases of foraminal cement leakage presented radiculopathy (7). Even if some cases of radiculopathy are managed by corticosteroids or nerve root block, surgical decompression is needed in other cases (7, 26).

Intervertebral disc leakage is frequent especially in cases of severe compressions. Peh et al. reported 35% of intervertebral disc leakage in a series of severe osteoporotic fractures (18). They also implied that the leakage was independent of the shape of the compression. Although this complication usually remains asymptomatic, long-term inconveniences may occur on adjacent vertebrae (Figure-4) (1, 9).

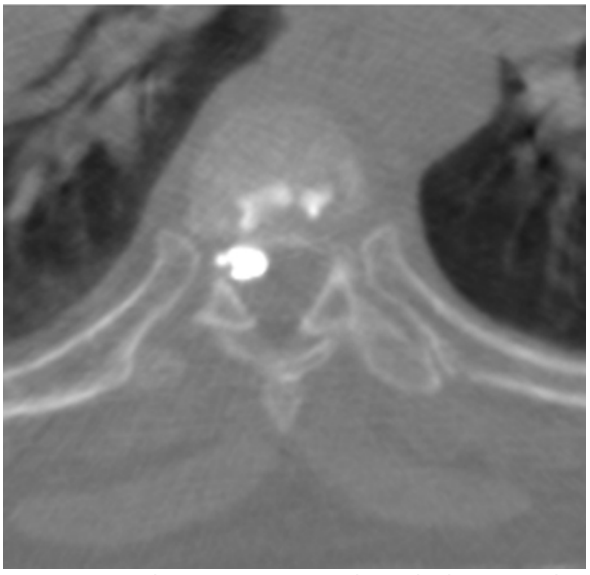

Figure-3. Axial CT scan passing through the T8-T9 disc space. The cement can be seen in the right side of the epidural space, in the right T7-T8 intervertebral foramen and in the T7-T8 disc space.

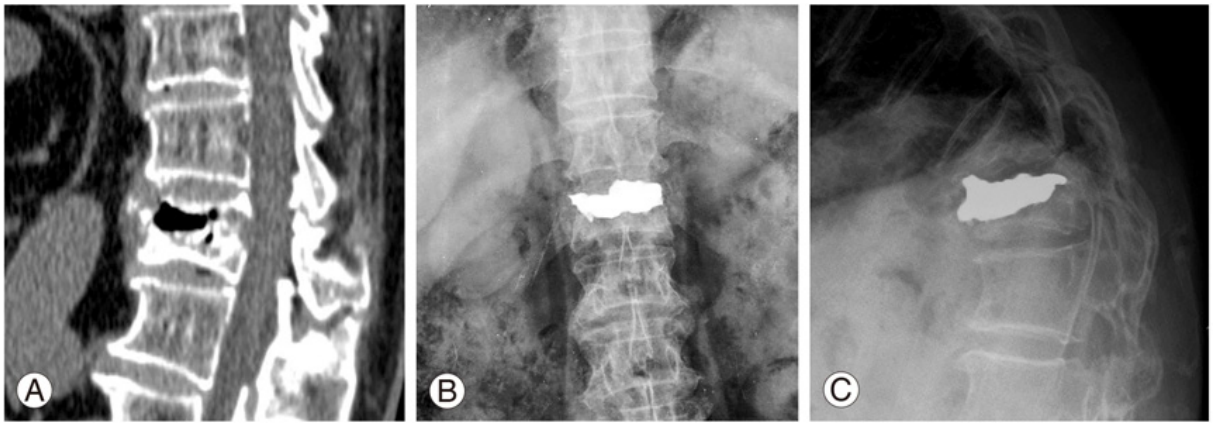

Figure-4. A patient with intravertebral vacuum cleft and upper end-plate disrupt (A), cement leak into intervertebral disk (B) and adjacent vertebral body fracture (C) at 3 months after the first surgery.

Intravenous cement leakage (Figure-5) can be seen up to 16,6 % of the cases (23). The majority of the cases with intravenous cement leakage show no clinical deterioration nevertheless catastrophic results as pulmonary embolism have been reported (24). Cement may also leak into the inferior vena cava asymptomatically (23,26). Wang et al. reported their large review of pulmonary cement embolism associated with percutaneous vertebroplasty or kyphoplasty in 2012 (24). They reviewed five observational studies consist of three retrospective studies and two prospective studies. Fifty-one cases in all with cement pulmonary embolism were noted in the observational studies. Among these 51 cases, 50 cases were secondary to PV and one case was following percutaneous kyphoplasty (PK). In the 32 case reports, 35 patients (34 following PV and 1 following PK) were diagnosed with pulmonary cement embolism, 30 were symptomatic and five were asymptomatic (21). To date, 5 lethal cases of pulmonary embolism associated with PV have been reported. Scroop et al. reported a case of paradoxical cerebral arterial embolization of PMMA together with pulmonary embolism of PMMA in a 78-year-old woman after multilevel intraoperative vertebroplasty for spinal fixation surgery (20). In that case, multiple pulmonary emboli of PMMA precipitated pulmonary hypertension and right-to-left shunting into the venous circulation through a patent foramen ovale. Intraarterial leakage is rare and may occur in highly vascularized lesions. Mozaffar et

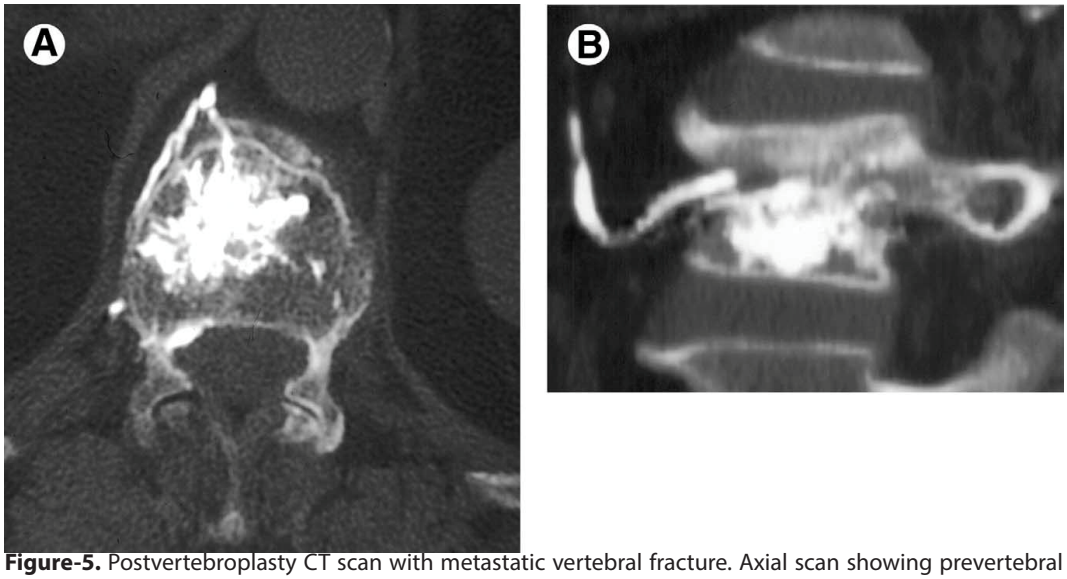

Figure-5. Postvertebroplasty CT scan with metastatic vertebral fracture. Axial scan showing prevertebral venous cement leakage (A). Sagittal reformatted image showing prevertebral venous cement leakage (B).

al. reported a lethal case of aorta and popliteal artery leakage following PV (16).

Pulmonary embolism rarely occurs and shows serious symptoms as already mentioned. It can be recognized if dyspnea, chest pain and tightness, respiratory distress and arrhythmia occurs. Many of the symptoms respond intensive care and medication. However, catastrophic complications as cardiac failure, multiple organ failure, severe cardiac tamponade and even death have been reported (24).

FACTORS INCREASING PMMA EXTRAVASATION RISK:

Cortical destruction, presence of an epidural soft tissue mass (Figure-6), highly vascularized lesions, and severe vertebral collapse are factors that are likely to increase the rate of complications (14). Weill et al. found that the complications associated with cement leakage in PV is not more frequent when there is a destruction in the posterior cortex of the vertebral body or epidural tumor mass (4,26). Still, the complication rate of PV for malignancies are much higher than osteoporotic fractures. Chiras et al. reported a complication rate of 10 % in malignancies, 2,5 % in hemangiomas and 1 % in osteoporotic collapse (3). Many authors have argued that severe collapse of the vertebral body (reduction of normal height more than 2/3) was a contraindication for PV (6, 26). However, Obrien et al. and Peh et al. reported in their series that the technique is not more difficult or complicated on severe collapsed vertebrae (17,18).

Needle approach and placement, cement viscosity, quality of fluoroscopy, and anatomical awareness and experience of physician as well as technician on PV are the other factors that influence the risk of PMMA extravasation.

COMPLICATIONS NOT RELATED TO PMMA LEAKAGE:

Infection following PV is quite rare. Chiras et al. reported only one case (an immunocompromised patient) of secondary infection (3). Local pain in PV area that usually lasts less than 72 hours may occur (4, 26).

It is controversial whether PV increases the risk of collapse of adjacent vertebrae. There is no prospective randomized study in the literature comparing the incidence of new vertebral fractures in patients with osteoporotic vertebral collapses either treated with PV or managed conservatively. Uppin et al. reviewed 177 osteoporotic patients treated with PV retrospectively after 2 years or more (22). They reported a total of 36 new vertebral fractures in 22 (12,4 %) patients. In another small series of 25 patients with osteoporosis, who had a total of 34 levels treated with PV, 13 (52 %) developed at least one new vertebral fracture at an average follow-up of 48 months (12). However, these results must be compared with the patients who managed conservatively. Lindsay et al. evaluated the risk of new vertebral fractures within 1 year following a vertebral fracture in patients with osteoporosis (15). They found an incidence of 19,2 % of new fractures within the first year following the initial fracture. Grados et al. reported the relative risk of fracture adjacent to a vertebrae treated with PV as 2,27

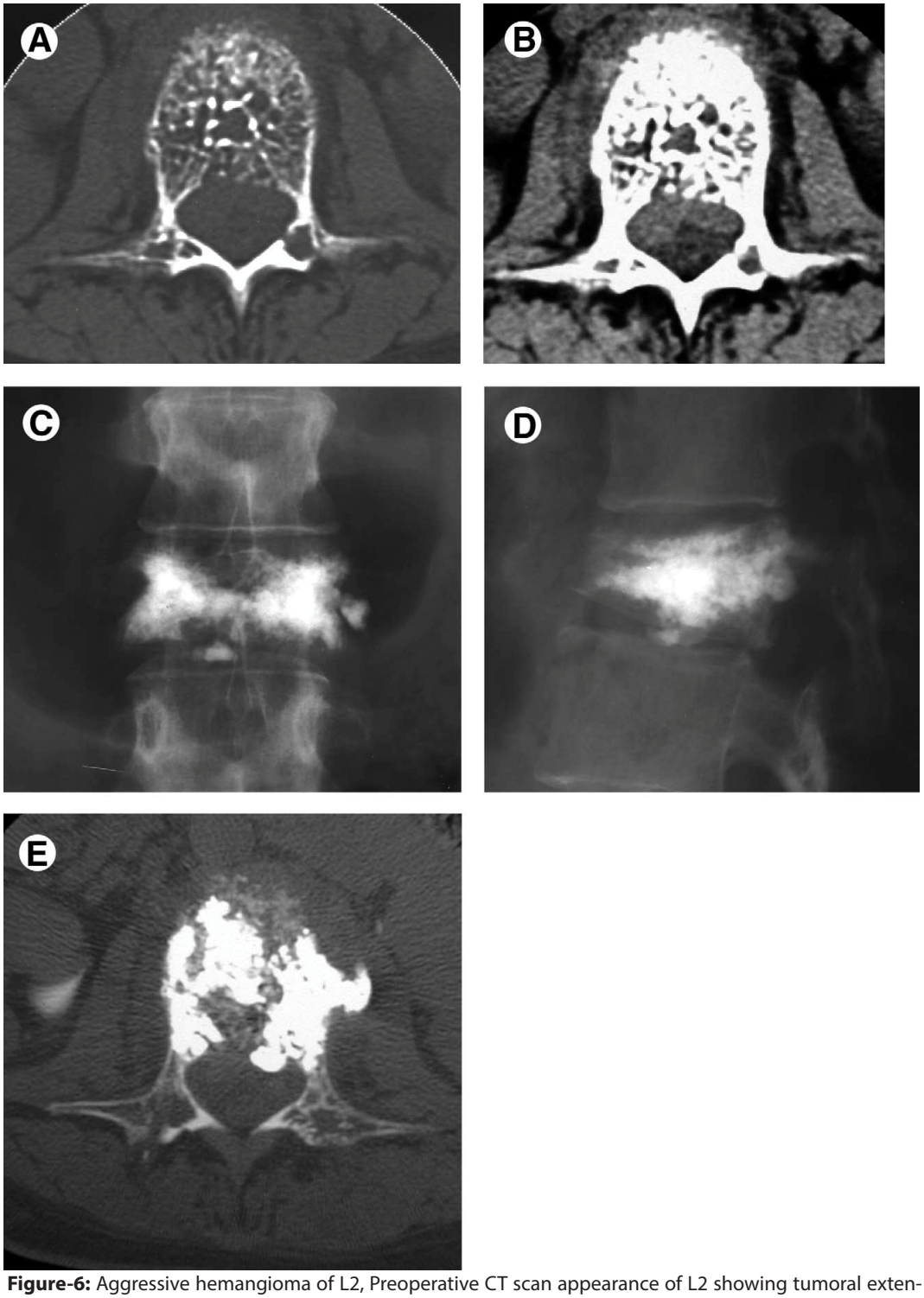

Figure-6: Aggressive hemangioma of L2, Preoperative CT scan appearance of L2 showing tumoral extension into the anterior epidural space (A and B). Anteroposterior and lateral radiographs after vertebroplasty (C and D). Postvertebroplasty CT scan (E).

(12). Uppin et al. reported a 67 % incidence of new fractures adjacent to a vertebrae treated with PV, and 67 % of them occurred within 30 days after treatment of the initial fracture (22). However, these studies are not enough to conclude the effect of PV in new fractures, since bone loss may occur in vertebral bodies adjacent to a fracture (25). Prospective randomized studies are needed for a better conclusion about the effect of PV on new fractures in the adjacent vertebrae.

Systemic reactions during VP are quite rare, but may progress mortal. Vasconcelos et al. reported one case of sudden decrease in blood pressure after PMMA injection (23). Weill et al. reported a case died through pulmonary embolism without an evidence of cement on the chest radiograph (26). Although some authors have mentioned fat embolism as a potential complication of PV, there is no report of a complication that can be shown to be related to fat embolism (2, 11).

There are no certain evidences to support the responsibility of PMMA injections in reported general reactions.

PV is not a procedure free of severe complications. PMMA extravasation is a frequent and usually well tolerated complication of PV. There are many factors influencing the complication rate such as needle approach and placement, cause of vertebral collapse, presence of cortical destruction, cement viscosity, quality of fluoroscopy and anatomical awareness and experience of physician as well as technician on PV. Physician must be aware of possible complications and signs of them, otherwise it may be very difficult or impossible to treat the complications.

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FRONTIERS OF SPINE SURGERY / *OMURGA CERRAHİSİNİN ÖNCÜLERİ*

PROF. AZMİ HAMZAOĞLU, M.D.

PROF. DR. AZMİ HAMZAOĞLU

I. Teoman BENLI[1], Yener ERKEN[2]

SUMMARY

Prof. Dr. Azmi Hamzaoğlu was born in 1956 in Sinop. He became an Orthopaedics and Trauma professor in 1996 and founded the ecole of Florence Nightingale Hospital. Prof. Dr. Hamzaoğlu is a true pioneer of Turkish spinal surgery, having contributed immensely to his field, especially by cultivating and mentoring many of today's Turkish spinal surgeons.

Key words: Prof. Azmi Hamzaoğlu, Florence Nightingale Hospital, scoliosis, traction x-rays

Level of Evidence: Biography, Level V

ÖZET

Prof. Dr. Azmi Hamzaoğlu, 1956 yılında Sinop'ta doğdu. 1996 yılında Ortopedi ve Travmatoloji uzmanı oldu ve Florans Nightingale ekolünü kurdu. Bu gün Türkiye'de bir çok spinal cerrahının yetişmesine büyük katkıları olan Prof. Dr. Azmioğlu, omurga cerrahisinin her alanında gelişmeyi sağlamış ve bir çok yeniliği ülkemiz omurga cerrahisine kazandırmış, asla yeri doldurulamaz, gerçek bir omurga cerrahisi öncüsüdür.

Anahtar Kelimeler: Azmi Hamzaoğlu, Florans Nightingale Hastanesi, skolyoz, traksiyon grafileri.

Kanıt Düzeyi: Biyografi, Düzey V

INTRODUCTION:

Prof. Dr. Azmi Hamzaoğlu was born in 1956 in Sinop. He became an Orthopaedics and Trauma professor in 1996 and founded the ecole of Florence Nightingale Hospital. Prof. Dr. Hamzaoğlu is a true pioneer of Turkish spinal surgery, having contributed immensely to his field, especially by cultivating and mentoring many of today's Turkish spinal surgeons (26).

LIFE STORY:

Prof. Dr. Azmi Hamzaoğlu was born into a wealthy family as one of eight children in the Ayancık province of Sinop. His father, Cemil, was a businessman with a high school education who opened several gas stations around Sinop. Mr. Cemil had four children each from his first and second marriage. Aside from the gas stations he owned and operated, he also owned several number mills (Figure-1) (31).

Figure-1. Prof. Azmi Hamzaoğlu, M.D.

Prof. Dr. Hamzaoğlu completed his elementary and middle school education in Ayancık. He graduated middle school at the top of his class. Although he spent every summer and every day after school at his father's gas stations as a pump attendant, he still managed to be a successful student in every class (Figure-2) (31).

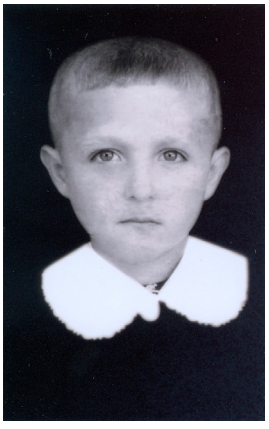

Figure-2. Prof. Hamzaoğlu, in primary school.

[1] Prof., M.D., Director of the Department of the Orthopaedics and Traumatology, Şişli Kolan International Hospital, İstanbul.
[2] Assoc. Prof., M.D., Department of the Orthopaedics and Traumatology, Şişli Kolan International Hospital, İstanbul.

Figure-3. Prof. Azmi Hamzaoğlu, in Kabataş Boy High School.

A recognition for finishing middle school first in his class, he was admitted into Istanbul Kabatas Boys High School in 1970. He still says his high school years at this boarding school on the banks of the Bosporus were the best years of his life (31) (Figure-3).

Prof. Dr. Azmi Hamzaoğlu made his family proud once again when he completed Istanbul Kabatas Boys High School as valedictorian of his class. He also learned a decent amount of French during his time in high school. He decided he wanted to be an electrical/electronic engineer. However, because of his family's (and especially his father's) insistence for him to become a medical doctor, he started Istanbul University, Çapa Medical School. While he was a university student, he stayed at a house his father had rented for him and his three friends from high school. He spent the majority of his time either studying or working at the orthopaedics and trauma clinic (26,31).

During his school years, he discovered his passion for football, and although he got the chance to play on Besiktaş's youth team, because he didn't have the support of his father, he continued to play football only for fun throughout his years in high school and university (31).

In 1979, shortly after becoming a medical doctor, he started his residency at Istanbul University's Çapa Medical School, in the Orthopaedics and Trauma Department (31).

He had a friend who suffered from chronic tibial osteomyelitis and who underwent numerous unsuccessful surgeries. Dr. Hamzaoğlu's determination to find a solution for his friend's condition was one of the reasons he chose to complete his residency in orthopaedics and traumatology after he graduated from medical school. When Dr. Hamzaoğlu started his residency, he had the privilege of being trained under some of the most indispensible professors of the time, including Prof. Dr. Fahri Seyhan (who was the Department Chief at the time), Prof. Dr. Alp Göksan, Prof. Dr. Bahattin Oğuz Temuçin, Prof. Dr. Orhan Baykur, Prof. Dr. Yilmaz Akalın, and Prof. Dr. Mişel Kokino. Unfortunately, most of these valuable professors are now currently deceased. At the beginning of his residency, Prof. Dr. Ünsal Domaniç was the Chief of Residents, while Prof. Dr. Remzi Tözün and Prof. Dr. Ünal Kuzgun were senior residents, and Prof. Dr. Harzem Özger, Prof. Dr. Mehmet Çakmak and Prof. Dr. Ömer Taşer were same-year residents as Hamzaoğlu. Dr. Hamzaoğlu also had the opportunity to work with Dr. Fethiye Ayhan, who was one of the first female orthopaedic surgeons in Turkey (31).

In his freshman year of residency, Dr.Hamzaoğlu was tasked with making the Risser cast with Prof. Dr. Bahattin Oğuz Temuçin, who was initially trained by Dr. Stagnara in Germany and France. This task of

Figure-4. Prof. Nihal Hamzaoğlu, wife of Prof. Hamzaoğlu.

making the Risser casts became the foundation of Dr.Hamzaoğlu's desire to start a career in spinal surgery. It was because he spent nearly three years of his residency working with Dr. Temuçin that he became so well trained in spinal surgery (31).

In 1981, he married Dr. Nihal Hamzaoğlu, who was a year behind Dr. Azmi Hamzaoğlu, completing her residency in physical therapy and rehabilitation. His daughter, İpek, was born in 1989 and in 1990, his son, Cemil, who was named after Dr. Hamzaoğlu's father, was born (31) (Figure-4).

Currently, his daughter, İpek, is completing her Master's in Fine Arts in the United States. His son, Cemil, received his degree in Business and is currently working the in energy sector (31).

In 1983, after completing his residency, Dr. Hamzaoğlu spent two tears at İstinye State Hospital as his mandatory service obligation. After completing his mandatory military service, Dr. Hamzaoğlu returned to the university clinic. In 1989, he became an associate professor and in 1996, he received the title, Professor (31).

In 1989, Dr. Hamzaoğlu went to the United States and worked as a fellow at the Twin Cities Spine Center in Minnesota. During his spinal surgery training here, he received indispensible training and experience from Prof. Dr. Robert Winter, Prof. Dr. John Lonstein, and Prof. Dr. Francis Denis, three of the biggest experts in the world in the fields of scoliosis, spine trauma, and congenital deformities (31).

In 1991, Dr. Hamzaoğlu studied spine tumors for a month at Hakaido University in Japan (31) (Figure-5).

In 1993, he became an SRS member and in 2008, he served on the International Relations Commission Board of Members (31).

After years of dedicated service, Dr. Hamzaoğlu separated from Istanbul University Çapa Medical School in 2003 (31).

Dr. Hamzaoğlu, who had started working part-time at Florence Nightingale Hospital in 1996, started working full-time in 2003 after separating from Istanbul University. Here, he established a clinic that focused solely on spine surgeries. He named this clinic Istanbul Spine Center, which was the first center of its kind in all of Turkey (31).

Dr. Hamzaoğlu achieved fame with his successful surgery of actress Fatma Girik, who had an L-1 burst fracture after falling off of a horse. Sometime later, when Dr. Hamzaoğlu operated on another actor, Tamer Yiğit, for a cervical fracture, he gained even more popularity when he appeared in all of the national newspapers (31) (Figure-6).

Other famous and noteworthy people Dr. Hamzaoğlu has operated on include Korkut Eken (who became quadriplegic after a cervical fracture), journalist Hıncal Uluç (who had a cervical disc hernia), Galatasaray Sports Club president Faruk Süren, Galatasaray football team coach Müfit Erkasap, businessman Ferit Şahenk, father-in-law of businessman Murat Ülker, former Turkish Prime Minister Mesut Yilmaz's wife, Berna Yılmaz, uncle of Fenerbahçe Sports Club President Aziz Yıldırım, and finally, current Turkish President Recep Tayyip Erdoğan's mother (due to an osteoporotic vertebral fracture) (31) (Figure-7).

Figure-5. Prof. Hamzaoğlu, in the operating room.

Figure-6. Prof. Hamzaoğlu, in the television programme.

Figure-7. The news about the journalist Hıncal Uluç in a newspaper.

Because of his incredibly busy 20-year non-stop schedule, Dr. Hamzaoğlu has made a well-deserved name for himself in the history of Turkish spinal surgery. There is virtually no individual who undergoes scoliosis surgery without first getting Dr. Hamzaoğlu's medical opinion (31).

Prof. Dr. Azmi Hamzaoğlu once shared an anecdote at a NASS Congress in New York. After coming home between 11 p.m. and midnight every day for years, one day when he came home early to prepare to leave for another congress, his children greeted him at the door in tears. They were crying because they thought their father was home early because he was sick. Despite this very busy schedule, Dr. Hamzaoğlu still manages to squeeze in an hour of tennis twice a week, and has Sunday brunch and a fish dinner once a week with his family (31)(Figure-8).

Figure-8. Prof. Hamzaoğlu, with his tennis friends.

CONTRIBUTIONS TO SPINAL SURGERY:

Prof. Dr. Azmi Hamzaoğlu has contributed greatly not only to orthopaedic surgeons, but also to neurosurgeons in the field of spinal surgery. Nearly all of Dr. Hamzaoğlu's internationally published articles are about spine surgery (1-30, 32-54). He not only trained his many residents while at Istanbul University, but he also trained and mentored countless orthopaedic surgeons via his courses, meetings and fellowships held at the Istanbul Spine Center he founded at Florence Nightingale Hospital (Figure-9).

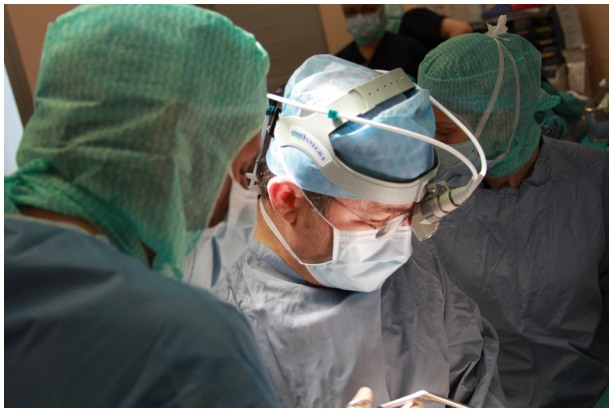

Figure-9 Prof. Hamzaoğlu, in the operation room in İstanbul Florance Nightingale Hospital.

He is the first surgeon in Turkey to apply the combined anterior-posterior spine surgery technique (31). He is also the first surgeon to perform a combined anterior-posterior convex hemiepiphysiodesis in congenital scoliosis in Turkey (15). In 1990, he began to use the Cotrel Dubousset system, operated on many scoliosis cases, and made a name for himself in the field of scoliosis. From then on, almost every parent who had a child suffering from scoliosis wished to apply to Dr. Hamzaoğlu for his medical opinion (26,31).

He was the first surgeon in Turkey to use the anterior Zielke system in 1991 and the anterior Kaneda system in 1992. Both systems gained popularity in Turkey after Hamzaoğlu's use of them (26,31). Prof. Hamzaoğlu was the first to perform a total hemivertebrectomy using the posterior approach and the first

to perform the posterior vertebral colon resection (PVCR) osteotomies technique in Turkey. His very successful use of the PVCR osteotomy technique on his large series of patients are published in many of the top spine journals (32,43) (Figure-10).

Figure-10. Prof. Dr. Hamzaoğlu became the president of the Turkish Spine Society (TOD) in 2003. At that time, the Turkish Spine Society was one of the few branch associations that carried the word "Turkish" in the title.

What makes Prof. Dr. Azmi Hamzaoğlu most well-known internationally is his practice of taking traction x-rays of his patients while they are under general anesthesia so he can revise his final surgical planning as necessary. This way, patients are operated on while under traction, and their very rigid curves are fully corrected without the need for additional anterior procedures or osteotomies (23,25).

Prof. Dr. Hamzaoğlu's other contribution to the world of spinal surgery, almost as important as his contribution to Turkish Spinal Surgery, is the algorithm he devised for the treatment of congenital thoracic lordoscoliosis (32,43)

Prof. Dr. Hamzaoğlu might also be the first orthopaedic surgeon to perform a cervical discectomy in Turkey. (We would also like to take this opportunity to wish a speedy recovery of his recent diagnosis of cerebrovascular disease to our dear Prof. Dr. Ridvan Ege, who was the first orthopaedic surgeon in Turkey to perform a lumbar discectomy and the first to publish an 11-patient series.) However, we are certain that Prof. Dr. Hamzaoğlu was the first to perform an endoscopic lumbar discectomy using the Matrix system (35).

Prof. Dr. Hamzaoğlu was the first to perform an anterior-posterior total vertebroctomy in one session and is still the person who performs this procedure most often (14,37,40).

Prof. Dr. Hamzaoğlu organized the GICD Congress in 1999 and the International Bosporus Spine Congress in 2000, 2001, and 2003. Additionally, he attended nearly 50 international congresses in which he was personally invited to speak or to give a presentation (26,31).

Prof. Dr. Hamzaoğlu became the president of the Turkish Spine Society (TOD) in 2003. At that time, the Turkish Spine Society was one of the few branch associations that carried the word "Turkish" in the title. Allowing neurosurgeons to become members of the association first began under his term as president. To make way for this, Prof. Dr. Hamzaoğlu organized a hands-on spine course strictly for neurosurgeons. Additionally, he organized the International Turkish Spine Surgery Congress in 1992. This congress was talked about on an international level and was attended by many foreign speakers who were experts in their respective fields (26).

In 2004, when Prof. Hamzaoğlu was Turkish Spine Society president, he worked to move the SRS annual congress to Istanbul. However, after the British Consulate and HSBC bombings, the congress was moved at the last minute to Brazil. Two years later, Prof. Dr. Hamzaoğlu became the regional SRS meeting president and held the course in Istanbul.

He served on the SRS International Relations Committee in 2005-2006.

Prof. Dr. Hamzaoğlu personally trained countless orthopaedic surgeons by allowing them to work by his side. He also provided many of those training under him to attend training headed by other valuable experts, especially such as Dr. Transfeld and Dr. Asher (26,31).

Prof. Dr. Hamzaoğlu was the first doctor in Turkey

who was visited under the SRS Traveling Fellowship. Dr. Alex Vaccaro and Dr. Timothy Kuklo, who are considered to be two of today's best spinal surgeons, were just two of the many participants of this fellowship program (31).

Currently, Istanbul Spine Center hosts a one-year fellowship program, which is mostly attended by Middle Eastern, Asian and African orthopaedic surgeons and neurosurgeons and Turkish surgeons working in eastern and southeastern Anatolian universities. The program is in its fourth year, and to this day, 10 foreign fellows and many Turkish spinal surgeons have completed their fellowship.

CONCLUSION:

In conclusion, Prof. Dr. Azmi Hamzaoğlu's flawless character, his caring personality, his knowledge and experience, and his countless publications have made him an indispensible pioneer of modern spinal surgery, not just in Turkey, but worldwide. I personally (T.B.) owe him greatly and will always think of him with gratitude and admiration. In all honesty, a spinal surgeon who hasn't benefitted from the contributions of Prof. Dr. Hamzaoğlu is virtually nonexistent. With his incredible passion for his job and his unbelievable work ethic, he has earned every bit of all he has achieved.

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CME QUESTIONS / *STE SORULARI*

1- What is the end result about the shoulder asymmetry in the study of Güler et. al.?

a) Surgical treatment dose not effort to coronal balance

b) Coronal balance is not changed post-operatively

c) Shoulder imbalance is rarely undesirable effect of correcting thoracic curve in surgical treatment

d) Unless shoulder imbalance is severe, it does not cause patient dissatisfaction.

e) None

2- How many idiopathic scoliosis patient was included in the study of Güler *et al*?

a) 13

b) 18

c) 23

d) 33

e) 43

3- Which one morphometric value was used in the study of Özkunt *et al*?

a) Hight of disc

b) Sagittal index

c) Spinopelvic inclination angle

d) Sacral slop

e) SRS24

4- How many patient with the degeneration of the adjacent disc was determined in the study of Özkunt *et al*?

a) 9

b) 19

c) 29

d) 39

e) 49

5- Which sentence of the below <u>is not</u> correct according to the study of Özdemir *et al*?

a) The VAS scores is significantly decreased during the follow-up period.

b) Mean age of the females is 68±8.8 years

c) This study is included 28 patient

d) The results of unilateral approach bilateral microdecompression is satisfactory.

e) Bilateral wide approach is the best technique for the lumbar spinal stenosis.

6- What did it find about comparison with pre and postoperative VAS and ODI scores in the study of Erdoğan *et al* statistically?

a) No difference in all values
b) Important difference in all values
c) No difference in only VAS scores
d) No difference in only ODI scores
e) None

7- Which pain score was used in the first study of Erdoğan *et al.*

a) SRS22 and VAS
b) SRS24 and ODI
c) VAS and ODI
d) JOA and ODI
e) SF-32 and JOA

8- Which one of the below is incorrect according to the results of the second study of Erdoğan *et al*?

a) The average follow-up of the patients was 138 months.
b) The analyses revealed that all VAS scores were improved significant statistically
c) No major complications or recurrences were observed on the patients.
d) 5 of the patients were undergone operation with transaxillary approach.
e) All patients operated for TOS diagnosed showed successful results.

9- Could radiofrequency thermoablation an effective option of pain management for coccidinia according to the study of Süslü *et al*?

a) No effective
b) Less effective
c) Final step
d) More effective
e) Contraindicated

10- Which complication of the patient with anterior hyperosteosis was presented according to the case report of Özdoğan *et. al.* ?

a) Dysphonia
b) Dispne
c) Pain of neck
d) Dysphagia
e) Quadriplegia

JTSS 26(1) issue CORRECT ANSWERS OF CME QUESTIONS:

1. c
2. d
3. e
4. a
5. b
6. a
7. c
8. d
9. c
10. d