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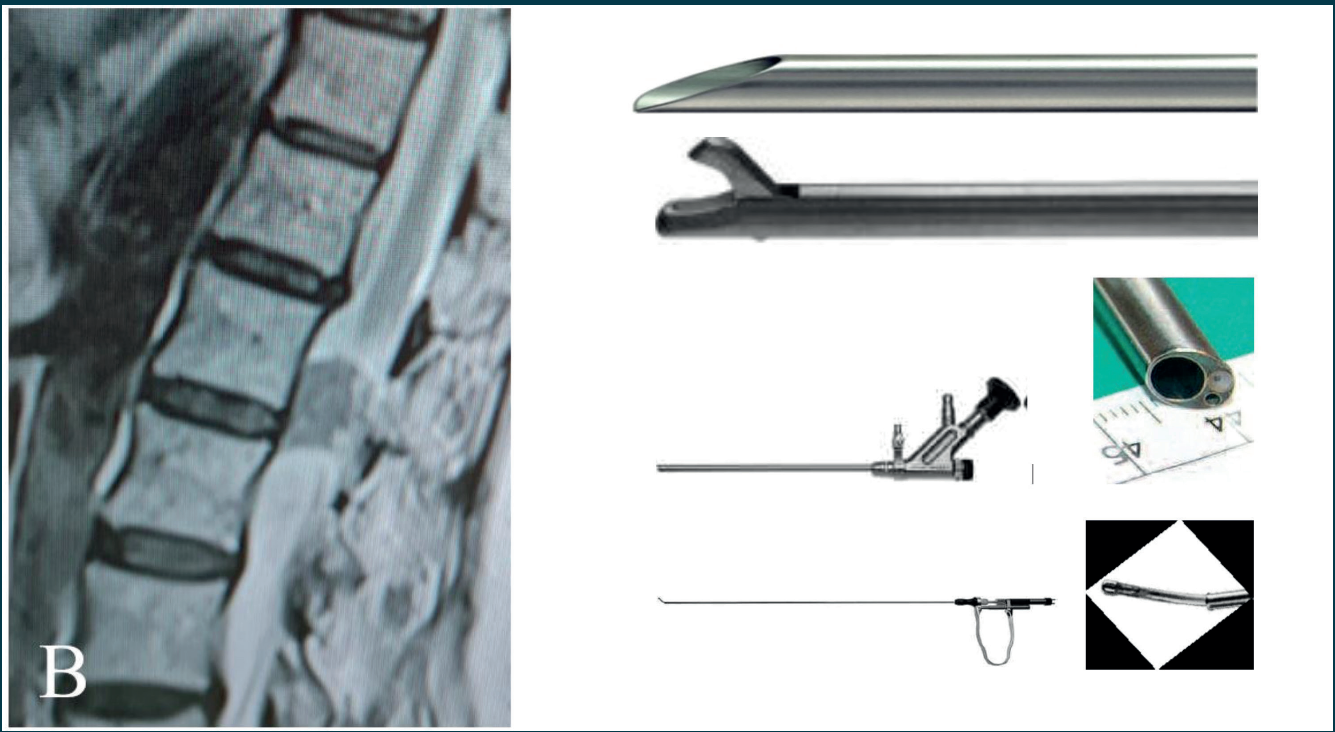

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Sinir Sistemi Cerrahisi Derneği'ne ait dergimizin bu yılın ilk sayısına, makaleleriyle bilimsel katkıda bulunan tüm kliniklere ve değerli hekim arkadaşlarımıza çok teşekkür ederiz. 2022 yılındaki diğer sayılarımızı da düzenli olarak çıkarıp yakın gelecekte ULAKBİM başta olmak üzere pek çok dizinde dergimizin listelenebilmesi ulusal ve daha sonra da uluslararası alanda Tıp bilimine önemli katkılar sunacaktır.

Değerli meslektaşlarımızın dergimize olan katkılarının artarak devam etmesinin bu anlamda çok önemli olduğunu biliyor ve bilimsel içeriği her defasında daha da zengin sayılarla birlikte olmayı temenni ediyoruz.

Saygılarımızla,

Prof. Dr. Serdar Kabataş

Prof. Dr. Erdinç Civelek

Araştırma Makalesi / *Research Article*

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Servikal Laminoplastide 25 Olguluk Deneyimimiz; Retrospektif Çalışma

Our Experience of 25 Cases for Cervical Laminoplasty; Retrospective Study

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ÖZ

Amaç: Servikal spondilotik miyelopati (SSM) servikal vertebrada dejeneratif değişikliklere bağlı gelişen ve spinal kanalda stenoza neden olan nörolojik bir bozukluktur. Çok seviyeli SSM, servikal konjenital dar kanal ve posterior longitudinal ligaman ossifikasyonunda (PLLO) cerrahi tedavi seçimi tartışmalıdır. Çalışmamızda servikal laminoplastik cerrahi yöntemle opere edilen SSM'li hastaların cerrahi sonuçları "JOA" skorlama yöntemi kullanılarak değerlendirilecek ve yöntemin etkinliği literatür bilgileri eşliğinde tartışılacaktır.
Yöntem: Hastanemiz Nöroşirurji kliniğinde 2014-2019 tarihleri arasında laminoplasti yöntemiyle opere edilen 8'i kadın, 17'si erkek toplam 25 SSM ve PLLO'lu hasta retrospektif olarak incelendi. Elde edilen sonuçlar "JOA" skorlama yöntemi kullanılarak değerlendirildi. İstatistiksel analiz için SPSS 15.0 for Windows programı kullanıldı. İstatistiksel alfa anlamlılık seviyesi p<0,05 olarak kabul edildi.
Bulgular: Sonuçlar incelendiğinde preop JOA ortalaması 11,2±3,4 iken postop JOA ortalaması 14,5±2,1 olarak tespit edildi. Fark ortalaması 3,4±2,9 olarak bulundu ve bu sonuç istatistiksel olarak anlamlı idi (p<0,001). Çalışmamızda opere edilen SSM ve PLLO'lu toplam 25 olgunun uzun dönem takiplerinde 16 olguda klinik düzelme gözlendi, 8 olguda preop dönem ile karşılaştırıldığında fark izlenmedi, 1 olguda geçmeyen boyun ağrısı tespit edildi.
Sonuç: Laminoplasti, SSM, PLLO ve diğer nedenlere bağlı olarak gelişen multipl seviyeli servikal stenoz tedavisinde giderek daha popüler hale gelmektedir. Diğer cerrahi yöntemler ile karşılaştırıldığında laminoplasti daha fizyolojik ve daha az komplikasyon oranlarına sahip olması nedeniyle özellikle çok seviyeli SSM ve PLLO'lu hastalarda en iyi seçenek gibi görünmektedir.

Anahtar Kelimeler: Laminoplasti, miyelopati, joa skorlaması, spondiloz

ABSTRACT

Introduction: Cervical spondylotic myelopathy (SSM) is a neurological disorder caused by degenerative changes in the cervical vertebrae and stenosis in the spinal canal. Surgical treatment options for multi-level SSM, cervical congenital narrow canal, and posterior longitudinal ligament ossification (PLLO) are debatable. In this study,

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surgical results of patients with SSM who were treated with cervical lamininoplastic surgery using “JOA” scoring method and the efficiency of the method were evaluated.
Methodology: We retrospectively analyzed 25 patients with SSM and PLLO, who were operated on by laminoplasty between 2014 and 2019 in our Neurosurgery clinic. The results were evaluated using the “JOA” scoring method. SPSS 15.0 for Windows program was used for statistical analysis. Significance level was accepted as P<0.05.
Results: Preop JOA mean score was 11.2± .4, while post op JOA mean was 14.5±2.1. The mean difference was statistically significant (p<0.001). Clinical improvement was observed in 16 cases of long-term follow-up of 25 patients with SSM and PLLO who were operated in this study. No change was observed in 8 cases compared to the preop period and only one patient reported a refractory neck pain.
Conclusion: Laminoplasty becomes more popular in the treatment of multiple levels of cervical stenosis due to SSM, PLLO, and other causes. Because of laminoplasty is more physiologic and has less complication rates than other surgical methods, it seems to be the a reasonable option for patients with SSM and PLLO, especially for multilevel patients.

Keywords: Laminoplasty, myelopathy, joa scoring, spondylosis

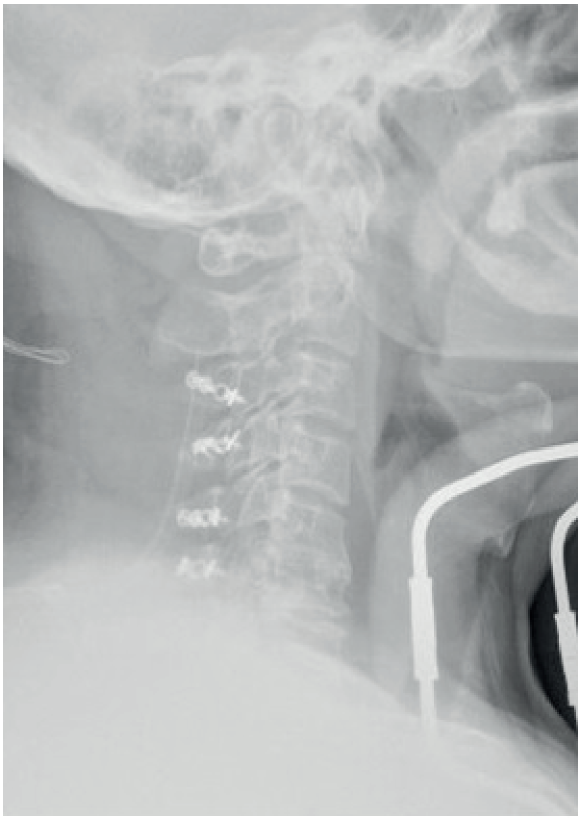
GİRİŞ

Servikal spondilotik miyelopati (SSM) servikal vertebrada dejeneratif değişikliklere bağlı spinal kanalda stenoza neden olan nörolojik bir bozukluktur ve intervertebral diskte başlayıp çevredeki kemik ve yumuşak dokularda devam eden dejeneratif bir hastalıktır. Çok seviyeli SSM, servikal konjenital dar kanal ve posterior longitudinal ligaman ossifikasyonunda (PLLO) cerrahi tedavi seçimi tartışmalıdır. Özellikle servikal dejeneratif hastalıklarda laminektomi uzun yıllar en çok kullanılan yöntem olarak yer almıştır [24,25,27]. Ancak laminektomi sonrası gelişen membran, kifotik deformite ve instabilite gibi sorunlar bu yöntemin dezavantajları olarak bildirilmiştir [24,27]. Servikal spinal kanalı genişletmek amacıyla uygulanan laminoplasti yöntemi, servikal laminektomiye alternatif olarak dar kanala bağlı özellikle çok seviyeli SSM ve PLLO'da bir tedavi seçeneği olarak kabul edilmiştir [8]. Yöntemin çıkış amacı servikal spinal kanalı genişletmek, arka kemik yapıları korumak, instabilite ve deformitenin önüne geçmek, postlaminektomi membranının gelişmesinin önlemek olarak öngörülmüştür [9]. Planladığımız çalışmada servikal laminoplastik cerrahi yöntemle opere edilen SSM'li hastaların cerrahi sonuçları “JOA” skorlama yöntemi kullanılarak değerlendirilecek ve yöntemin etkinliği literatür bilgileri eşliğinde tartışılacaktır.

GEREÇ VE YÖNTEM

Bu çalışma Bakırköy Ruh ve Sinir Hastalıkları Hastanesi yerel etik kurulundan onay alınmasını takiben yapıldı. Şişli Hamidiye Etfal Eğitim ve Araştırma Hastanesi Nöroşirurji kliniğinde 2014-2019 tarihleri arasında SSM ve PLLO tanısı ile opere edilmiş ardışık 78 hasta retrospektif olarak incelendi. Yalnızca posterior laminoplasti yapılan, dosyalarına ve radyolojik tetkiklerine ulaşılabilen 25 hasta çalışmaya dahil edildi. Posterior stabilizasyon ve anterior korpektomi yöntemiyle opere edilen hastalar çalışmaya dahil edilmedi. Çalışmaya dahil edilen 25 hastanın 8'i kadın, 17'si erkekti. Yaş 38-78 (yaş ortalaması 60,4) idi. Takip süresi 7-78 aydı. Hastaların 21'i SSM, 4'ü ise PLLO'ya bağlı miyelopati tanısı almıştı. Yine hastaların 10'unda 3 seviye, 15'inde 3'den fazla seviyeyi içeren servikal patoloji mevcut idi. Çalışmaya dahil edilen tüm hastaların preop ve postop JOA skorları belirlendi. Hastaların tamamı tek merkezde ve open door laminoplasi tekniği kullanılarak opere edildi. Perop ve postop erken dönemde gross komplikasyon oluşmadı. Operasyon sonrası ortalama 3. günde hastalar externe edildi. Postop 1. günde servikal 2 yönlü direkt grafi ve servikal bilgisayarlı tomografi (BT) görüntülemeleri yapıldı (Resim 1). Taburculuk sonrası 1. ay direkt grafi, 3. ayda ise manyetik rezonans görüntülemeleri (MRG) ve klinik protokollere uygun şekilde takipleri yapıldı (Resim 2, 3A-

Resim 1. SSM tanısı ile opere edilen hastanın postop servikal sagittal BT görüntüsü

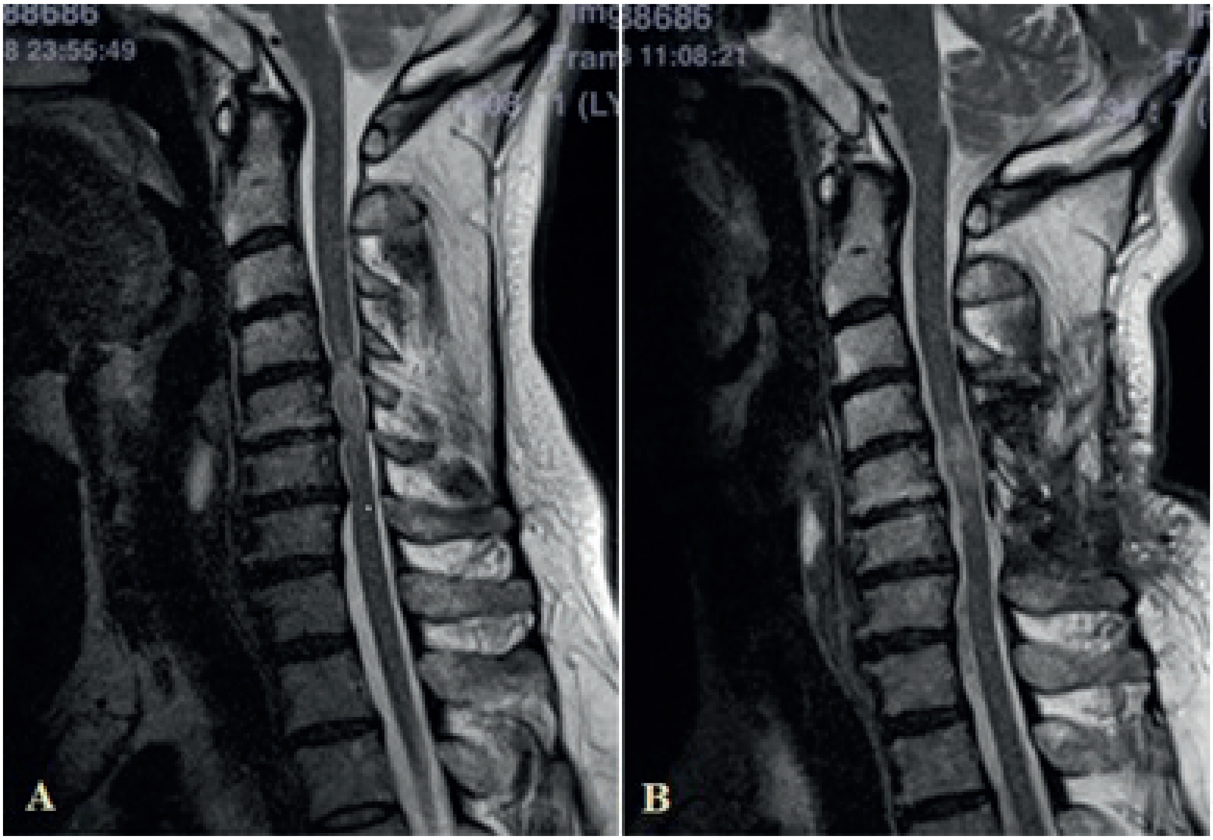


Resim 2. Multipl seviye SSM tanısı ile opere edilen hastanın postop servikal direkt grafisi

B). Radyolojik görüntülemeleri yapılmamış yada radyolojik tetkiklerine ulaşılamamış olan hastalar çalışma dışı bırakıldı. İstatistiksel analiz için SPSS 15.0 for Windows (IBM, Armonk, NY, USA) programı kullanıldı. İstatistiksel alfa anlamlılık seviyesi $p<0,05$ olarak kabul edildi.

Laminoplasti Teknikleri

İlk defa 1968 yılında Krita [6,19] tarafından tanımlanan laminoplasti SSM'li hastaların tedavisinde kullanılmış, 1973 yılındada Oyama [18] tarafından PLLO'lu hastaları tedavi etmek amacıyla tanımlanmıştır. Genişletilmiş Z plasti olarak adlandırılan bu teknikte spinöz çıkıntı alınır ve lamina, lamina-faset bileşkesine doğru inceltilir. Laminaların arası Z şeklinde kesilerek sütür veya telle tespit edilir [18]. Oyama'nın tarifinden sonra farklı laminoplasti teknikleri tarif edilmiştir. Bu farklılıklar laminanın ve spinöz çıkıntıların nasıl kesileceğini ve laminaların açıklığının korunması için tel, sütür, kemik blok, kemik kancaları, hidroksiapatit bloklar, miniplak, otogreft spinöz çıkıntı kullanımı ve bunların kombinasyonlarını içerir. Tüm laminoplasti tekniklerinde amaç; laminaların repozisyonu, spinal kanalın genişletilmesi, nöral yapıların dekompresyonu, posterior elemanların korunarak stabilizasyonun devamını sağlamaktır. Open-Door laminoplasti, French-Door laminoplasti, adele koruyucu laminolasti teknikleri kullanılan cerrahi teknikler arasında yer almaktadır. Bunların içinde en çok tercih edilen yöntem açık kapı laminoplasti tekniği olmuştur. Bu farklı tekniklerin birbirine çok belirgin üstünlükleri bulunmamaktadır [13]. Bizim çalışmamızda hastaların tamamı açık kapı laminoplasti tekniği kullanılarak opere edilmiştir.



Resim 3A-B. Multipl seviye SSM'li hastanın sagittal MR görüntüleri. A: Preop servikal MR görüntüsünde multipl seviye miyelomalazi görülmekte ve kanal daralması izlenmektedir. B: Postop dönmede servikal laminoplasti sonrası kanalı genişlediği ve spinal kordun dekomprese olduğu görülüyor

Cerrahi teknik

Hasta genel anestezi altında prone pozisyonda baş, çivili başlıkla tespitli ve boyun nötr olacak şekilde masaya alındı. Gerekli cilt temizliği ve steril örtümü takiben orta hat insizyonla cilt açıldı. Laminalar ve servikal lateral mass görülecek şekilde paraspinal kaslar bilateral monopolar koter ile sıyrıldı. Lamina ve lateral massların medialdeki birleşme yeri hastanın ağrısının daha fazla olduğu taraftan ilgili seviyeler boyunca ligamentum flavumlarına kadar yukardan aşağıya doğru lineer bir hatta drillendi. Aynı işlem lamina ve spinoz proçesleri esneterek kendi tarafımızdan bir kapı açmak amacı ile karşı tarafa da uygulandı. Ağrının daha çok olduğu taraftaki laminalar ve spinöz proçesler kontralateral tarafa carrison ronger ve dissektörler yardımı ile esnetilerek plak ve vidalara alan hazırlandı. Basının olduğu seviyelerde carrison rongeur ile ligamentum flavum alınarak nöral yapılar rahatlatıldı. Laminoplasti plaklarının bir ucu drillenen laminanın ucuna diğeri ise drillenen lateral mass yüzeyine gelecek şekilde mini vidalarla sabitlendi. Kanama kontrolünü takiben mesafeye hemovak dren konularak katlar anatomisine uygun şekilde kapatıldı. Böylece bir taraf lamina ve spinöz proçesleri esnetilerek spinal kanala posteriordan daha geniş bir alan sağlanmış oldu.

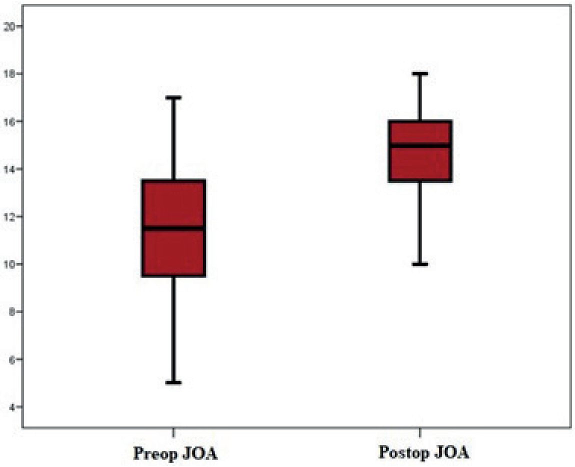
İstatistik inceleme

İstatistiksel analiz için SPSS 15.0 for Windows (IBM, Armonk, NY, USA) programı kullanıldı. Tanımlayıcı istatistikler; sayısal değişkenler için ortalama, standart sapma, %95 CI olarak verildi. Bağımlı iki grupta sayısal değişkenlerin karşılaştırmaları farkları normal dağılım koşulunu sağlamadığından Wilcoxon Analizi ile yapıldı. İstatistiksel alfa anlamlılık seviyesi p<0,05 olarak kabul edildi.

BULGULAR

Sonuçlar incelendiğinde preop JOA ortalaması 11,2±3,4 iken postop JOA ortalaması 14,5±2,1 olarak bulunmuştur. Fark ortalaması 3,4±2,9 olarak tespit edilmiş olup istatistiksel olarak anlamlı idi (p<0,001), (Tablo 1, Grafik 1). Çalışmamızda opere edilen SSM ve PLLO'lu toplam 25 olgunun uzun dönem takiplerinde 16 olguda klinik düzelme gözlendi, 8 olguda preop dönem ile karşılaştırıldığında değişiklik izlenmedi, 1 olguda ise geçmeyen boyun ağrısı tespit edildi. Preop ve postop JOA skorlamasına göre değerlendirildiğinde preop 11,2 olan JOA ortalamasının postop dönemde 14,5'a yükselmiş, hastaların laminoplasti operasyonundan klinik fayda gördüğü tespit edilmiş ve bu durum istatsitiksel olarakda ortaya konulmuştur.

TARTIŞMA



Grafik 1: JOA skoru preop ve postop sonuçları grafiksel olarak gösterilmektedir

SSM; servikal omurga bölgesinde spondiloz, dejeneratif, disk hastalığı, PLLO ve ligamentum flavum osifikasyonu sonucu oluşan ve myelopati ile sonuçlanan dejeneratif patoloji olarak tarif edilmektedir. Klinik belirtiler sıklıkla 5-6 dekatlarda sinsi bir şekilde başlar. Erkeklerde daha sık görülür. Klinik ilerleme oranı farklılık göstermektedir ve miye-lopati geliştikten sonra tam düzelme nadirdir [14]. Spondilozlu hastalarda SSM'nin şiddeti, her zaman nöral yapılara bası miktarıyla doğru orantılı değildir. Ciddi kord basısı olan hastalarda miyelopati semptomları olmayıp, ılımlı kord basısı olan hastalarda belirgin miyelopati bulguları meydana gelebilmektedir. Bu durumun muhtemel nedeni, multipl seviyedeki küçük çaplı basıların kord üzerindeki kümülatif etkilerine ve etkilenen seviyedeki aşırı hareketliliğe bağlı meydana gelen ilave basılarla ortaya çıkabileceği düşünülmektedir[4].

Servikal posterior dekompresyon yöntemleri servikal laminektomi, hemilaminektomi, foraminotomi, laminektomi ve posterior enstrümantasyon ve laminoplastidir [1,12,25]. Laminektomi özellikle servikal dejeneratif hastalıklarda uzun yıllar kullanılan yöntem olmuştur. Bu yöntemin dezavantajları ameliyat süresinin uzaması, maliyet, füzyon ile ilgili sorunlar, hareketin kısıtlanması ve komplikasyonlar ciddi bir sorun olarak bildirilmiştir [11,24]. Total laminektomi ile birlikte faset ekleminde tahrip edilmesi, spinöz çıkıntı ve posterior ligamanların alınması kifoz gelişme riskini artırması nedeni ile füzyon cerrahisine olan ihtiyaç artmıştır. Ayrıca laminektominin bir diğer komplikasyonuda zaman içinde gelişen ve spinal kanalın tekrar daralmasına neden olan laminektomi membranıdır [5]. Preop dönemde servikal lordoz kaybı olan hastalarda

Tablo 1. JOA skoru preop ve postop sonuçları tablo olarak gösterilmektedir

		Ort.±SD (%95 CI Min-Maks)	Fark Ort.±SD (%95 CI Min-Maks)	p
Preop	**JOA**	11,2±3,4 (9,7-12,6)	3,4±2,9 (2,2-4,6)	<0,001
Postop	**JOA**	14,5±2,1 (13,7-15,4)		

laminektomi, kifotik deformitenin ilerlemesine neden olabilir. Dejeneratif hastalığı bağlı laminektomi uygulanan ve lordoz kaybı gelişen hastalarda kifotik deformiteden sakınmak için posterior servikal enstrümantasyon ve füzyon yapılması önerilmektedir [3].

Üç ve/veya daha fazla disk seviyesinde kord basısı olan ve servikal lordozu korunan hastalar posterior dekompresyon için uygun hastalardır [20,21]. Spinal kanalın genişlemesiyle anterior bası etkisi azalacak ve laminektomiyle birlikte foraminotomininde yapılması ile radiküler ağrı, parestezi, motor kayıp, dermatomal duyu kayıplarının düzelmesinede katkı sağlayacaktır [7]. Laminoplastinin çok farklı varyasyonları tanımlanmış olmakla birlikte hepsindeki ortak nokta, posterior elemanlar çıkarılmadan spinal kanalın genişle-tilmesidir [2,23], (Resim 3A-B).

Laminoplastinin amacı; spinal kanalı genişletmek, posterior kemik yapıları ve servikal hareketi koruyarak nöral yapılar üzerindeki basıyı ortadan kaldırmak ve miyelopatinin ilerlemesini durdurmaktır. Miyelopatinin uzun süre devam ettiği olgularda cerrahinin faydası sınırlıdır. Bununla birlikte erken dönemde yapılan dekompresyon ile semptomlarda belirgin düzelme görülebilir [2,15].

Laminoplasti, laminektomi sonrası gelişebilecek olan laminektomi membranı, kifoz ve instabilite riskini azaltmak için geliştirilen bir posterior dekompresyon tekniğidir. Suk ve ark. [25] yaptıkları prospektif çalışmada postlaminektomi membranının laminoplasti sonrasında gelişmediğini bildirmişlerdir. Bizim çalışmamızdada hiçbir hastada postlaminektomi membranı gelişmemiştir.

Laminoplastinin en sık ve önemli komplikasyonlarından birisi aksiyel boyun ağrısıdır. Cerrahi sırasında servikal ekstansör kasların, supraspinöz-interspinöz ligamenlerin ve faset kapsüllerinin korunması ve postop erken egzersiz ile bu şikayetlerin azaltılabilmesi mümkündür [7]. Hirabayashi ve ark. multipl seviye spondiloz tanısıyla laminoplasti uyguladıkları 35 hastayı incelemiş ve bunlardan %54'ünün semptomlarının düzeldiğini ve uzun vadede kanal genişliğinin korunduğunu bildirmişlerdir [10]. Bizim çalışmamızda da 25 olgunun 16'sında klinik düzelme sağladığı tespit edildi ve bu sonuç literatür ile uyumlu idi.

Laminoplasti sonrası nörolojik iyileşme birçok çalışmada bildirilmiştir ve servikal dar kanalda uygun endikasyonda laminoplastinin etkinliği konusunda bir kuşku bulunmamaktadır [27]. Prospektif cohort çalışmalarda SSM'de iyileşmenin ilk yıl başladığı ve daha sonraki yıllarda da sürdüğü ortaya konulmuştur. Bu iyileşmede sürecinde hastanın yaşının da önemli olduğu vurgulanmıştır [26]. Genel olarak PLLO'da laminoplasti sonrası iyileşme %60 civarındadır [9,17]. Laminoplasti yöntemi literatürde gerek anterior cerrahi, gerekse diğer posterior cerrahi yöntemlerle ayrıntılı olarak karşılaştırılmış ve tartışılmıştır.

Sakaura ve ark. SSM'li hastalarda laminoplasti ve anterior servikal füzyon tekniklerini karşılaştırmışlar her iki yöntemde de nörolojik iyileşme sonuçlarının benzer olduğunu bulmuşlardır [20]. Anterior cerrahideki füzyon komplikasyonları, posterior cerrahi sonrası görülen kronik boyun ağrısı her iki yöntemin önemli handikapları olarak bildirilmiştir. Bu riskler göz önüne alındığında yazarlar belirgin dar kanal olmayan tek seviyeli disk basıları dışında laminoplastinin tercih edilmesi gereken yöntem olduğunu bildirmişlerdir [20]. Özellikle yaşlı ve multipl seviyeli stenozu olan hastalarda laminoplasti sonuçlarının anterior cerrahiye göre daha iyi olduğu saptanmıştır [22].

Laminoplasti ile laminektomi karşılaştırıldığında kasların daha iyi korunması, daha az kifoz ve instabilite ile laminoplastinin daha avantajlı olduğu bildirilmiştir. Nowinski ve ark. çok seviyeli laminoplasti ile laminektomiyi laboratuvar koşullarında karşılaştırmışlar laminektominin %25 veya daha fazla fasetektomi ile birlikte yapılması durumunda laminoplastiye göre servikal harekette çok daha belirgin artışa neden olduğunu saptamışlardır [16].

SONUÇ

Laminoplasti, SSM, PLLO ve diğer nedenlere bağlı olarak gelişen multipl seviyeli servikal stenoz tedavisinde giderek daha popüler hale gelmektedir. Laminoplasti yöntemi ile, greft ve füzyonla ilişkili komplikasyonlar, postoperatif kifoz- instabilite ve anterior yaklaşıma bağlı gelişebilecek komplikasyonların önüne geçilebilmektedir. Ancak laminoplasti, laminar kapanma, aksiyel boyun ağrısı ve servikal hareket ve dizilim kaybı gibi potansiyel komplikasyonlara sahiptir. Diğer yöntemler ile karşılaştırıldığında laminoplasti daha fizyolojik olması ve daha az komplikasyon oranlarına sahip olması nedeni ile özellikle çok seviyeli SSM ve PLLO'lu hastalarda en iyi seçenek gibi görünmektedir.

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The Big Data Awareness of Turkish Neurosurgeons: A National Survey

Türk Beyin Cerrahlarının Büyük Veri Farkındalığı: Ulusal Bir Araştırma

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ABSTRACT

Objective: The term big data refers to high volumes of data that are difficult to store, process, and analyze through traditional database technologies. This paper aims to discover the big data knowledge and awareness of Turkish neurosurgeons.

Methods: An online survey link was sent to all members of the Turkish Neurosurgical Society (n=1707 neurosurgeons) by e-mail. The survey, which was available during September and October 2021, was filled by 211 specialists (12.4%) neurosurgeons. Participants were scored based on the questions asked in "Big Data" and the scores were compared with baseline characteristics.There was no statistically significant correlation between baseline characteristics (age, gender, the residency/current institution, academic title, the presence of a Ph.D. degree, and professional specialist period) and survey score. The survey scores of the participants who used a big data platform, wrote code, thought that the use of big data was beneficial, and wanted to learn more about this subject were statistically significantly higher.

Conclusions: Obtaining information about big data seems to be related only to personal interests. Necessary arrangements should be made in the training programs of neurosurgeons on this topic, which is gaining in popularity and provides useful information for daily clinical practice.

Keywords: Big data, neurosurgeon, national survey

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ÖZ

Amaç: Büyük veri terimi, geleneksel veri tabanı teknolojileri aracılığıyla depolanması, işlenmesi ve analiz edilmesi zor olan yüksek hacimli verileri ifade eder. Bu makale, Türk beyin cerrahlarının büyük veri bilgisini ve farkındalığını keşfetmeyi amaçlamaktadır.
Yöntem: Türk Nöroşirurji Derneği'nin tüm üyelerine (n=1707 beyin cerrahı) e-posta ile online anket linki gönderildi. Eylül ve Ekim 2021'de online olarak erişilebilir olan anket 211 (%12,4) beyin cerrahisi uzmanı tarafından dolduruldu. Katılımcılar, "Büyük Veri" hakkında sorulan sorulara göre puanlandı ve puanlar temel özelliklerle karşılaştırıldı. Temel özellikler (yaş, cinsiyet, asistanlık yapılan/mevcut kurum, akademik unvan, doktora derecesinin varlığı ve uzmanlık süresi) ile anket puanı arasında istatistiksel olarak anlamlı bir ilişki yoktu. Büyük veri platformunu kullanan, kod yazan, büyük veri kullanımının faydalı olduğunu düşünen ve bu konuda daha fazla bilgi edinmek isteyen katılımcıların anket puanları istatistiksel olarak anlamlı derecede yüksekti.
Sonuç: Büyük veri hakkında bilgi edinmenin sadece kişisel merakla ilgili olduğu görülmektedir. Giderek artan ve günlük klinik pratiğe faydalı bilgiler sağlayan bu konuda beyin cerrahlarının eğitim programlarında gerekli düzenlemeler yapılmalıdır.

Anahtar Kelimeler: Büyük veri, beyin cerrahı, ulusal anket

INTRODUCTION

The concept of "Big Data", which emerged as the scale of data collection increased, became interpretable with the combination of statistics and computer science. The evolution of statistical modeling into machine learning led to artificial intelligence [1]. Event predictions, pattern recognition, and detailed image analysis are made possible by the existence of big data sets [2]. These stunning development paved the way for benefiting from large data sets in clinical practice. Machine learning is a constantly evolving and promising topic for decision-making in the treatment of different disease groups [3].

Big data is compared to traditional data; it is high volume, data generation speed is faster, can be structured/unstructured/semi-structured, the data source is fully distributed, data integration is difficult, and access is batch or real-time [4]. The backbone of big data consists of volume, velocity, variety, value, and veracity [5]. Big data analytics is used to detect hidden patterns and values that give an accurate expression of data [4,6,7].

In the last decade, the processing power and amount of research in big data analysis have been increasing [2]. In the current neurosurgical literature, big data analyzes are used in cranial [8-11], spinal [12-17], and peripheral nerve surgery [18]. The big data, which is stated to shape clinical practice [19] and improve the quality of patient care [2], needs to be noticed and benefited by today's neurosurgeons. This study aims to measure the knowledge and awareness level of Turkish specialist neurosurgeons about "Big Data".

MATERIAL AND METHODS

Online Survey

The online survey (Table 1) consisting of 21 questions was sent to all members of the Turkish Neurosurgical Society (n=1707 neurosurgeons) by e-mail. The answers of the participants who filled in all the questions in the survey were evaluated. Recurrent participation was not possible due to IP address tracking.

Two hundred and eleven specialists (12.4%) participated in the survey during September and October 2021. The participants were informed about the confidentiality of their data. All data were collected in an online database and then imported into Microsoft Excel. The questions in the survey were Turkish, the native language of the participants, and no residents participated in the survey. Ten questions specific to big data were evaluated out of a hundred points and the scores of the participants were compared with their baseline characteristics. The aforementioned ten questions were given scattered throughout the survey in order not to create the feeling of taking the exam in the participants.

Table 1. All questions from "The Big Data Awareness of Turkish Neurosurgeons: A National Survey" (* The Questions prepared to calculate the survey score)

Question	Possible responses
How old are you?	24–29, 30–34, 35–39, 40–44, ≥45
What is your gender?	Female, male
What is the nature of your residency institution?	Training and research/city hospital, state university, private university, foreign country
What is your academic title?	Specialist, assistant professor, associate professor, professor
Do you have a PhD degree?	Yes, no
How many years have you been a specialist neurosurgeon?	1–4, 5–8, 9–12, 13–16, ≥17
What is the nature of the institution you are currently working with?	State hospital, private hospital, state university, private university, training and research or city hospital/city hospital, foreign country
Big data can be defined as a collection of complex, unstructured, or semi-structured datasets*	Yes, no, I have no idea
The 5V concept of big data consists of volume, velocity, variety, value, and veracity*	Yes, no, I have no idea
No matter how big the size of big data increases, statistical significance does not change*	Yes, no, I have no idea
One of the biggest challenges of using big data is the shortage of storage space*	Yes, no, I have no idea
Data generation, data collection, data storage, data processing are the steps of big data*	Yes, no, I have no idea
Do you use any "big data" platform in your daily practice?	Yes, no
Hadoop, Cloudera, SPSS, and SAS are big data platforms*	Yes, no, I have no idea
Have you written code on any platform?	No, yes (one time), yes (two times), yes (three times), yes (more than three times)
I think big data platforms are useful in neurosurgery practice	Yes, no, I have no idea
Servers with very good features are required for the analysis of big data*	Yes, no, I have no idea
For a data to be called big data, it only needs to have a very large number of patients*	Yes, no, I have no idea
The reason why Hadoop is often used for big data analytics is that it is open source and low cost*	Yes, no, I have no idea
Big data platforms (applications) also allow the processing of media files*	Yes, no, I have no idea
I would like to know more about big data	Yes, no

Subgrouping of Questions and Participants

Questions were categorized into three groups: 1) base-line characteristics (including personal and institutional details), 2) questions measuring the level of big data knowledge (each question was evaluated as 10 points and the maximum total score that could be achieved was 100), and 3) interest and skills in big data. The survey score of participants were compared with questions categories 1 and 3.

Statistical Analysis

SPSS 11.5 program was used in the analysis of the data. Mean±standard deviation and median (minimum-maximum) were used as descriptors for quantitative variables, and the number of patients (percentage) for qualitative variables. The Mann-Whitney U test was used to determine whether there was a difference between the categories of the qualitative variable with two categories in terms of quantitative variables since the assumptions of normal distribution were not met. The Kruskal Wallis H test was used to determine whether there was a difference between the categories of the qualitative variable with more than two categories in terms of the quantitative variable since the assumptions of normal distribution were not met. The statistical significance level was taken as 0.05.

RESULTS

The baseline characteristics of participants are summarized in Table 2.

No statistically significant correlation was found between age, gender, the residency institution, academic title, the presence of a Ph.D. degree, professional specialist period, current institution, and survey score. (P=0.585, P= 0.986, P=0.544, P=0.065, P=0.781, P=0.276 and P= 0.113, retrospectively) (Table 3)

The survey scores of the participants who use any big data platform in their daily practice, who think that big data platforms are useful in neurosurgery practice, and who want to learn more about big data, are statistically significantly higher. (P=<0.001, P=<0.001 and P=0.048 retrospectively) In addition, the survey scores of the participants who wrote code twice on any platform were statistically significantly higher than the others. (P=0.008) (Table 4)

DISCUSSION

Although academic performance surveys have been conducted on similar populations [20] before, this study on big data awareness is a first in this regard. In our study, the fact that the survey scores could not be associated with baseline characteristics shows that Turkish health institutions do not have sufficient training programs on this subject and the awareness of big data is limited only to personal interest. In our previous study [20], although we determined that university hospitals in Turkey were superior in scientific activities, in this study, no superiority of these institutions could be determined about big data.

The adequacy of traditional clinical research methods, which cannot handle the volume, variability, speed, and accuracy of data, is questioned by data science. Although the basic principles of epidemiology, study design, and biostatistics remain important, they should be supported by machine learning and database management. Soon, programming skills will be one of the core competencies of the neurosurgeon. Educators should ensure that future neurosurgeons receive training on this subject [21].

A recent national survey study was conducted to question the effects of the COVID 19 pandemic on education for neurosurgery residents (participation rate was 54%) across Turkey. 59.6% of the participants in the study stated that they did not participate in any research during this period, 34.2% stated that research productivity decreased and 42% stated that they were concerned about residency training and future career [22]. The study [22] which shows that fundamental neurosurgery education was disrupted during the pandemic period, makes us think that future specialists will possibly not be interested in big data.

Currently, residency training in the Republic of Turkey is carried out in tertiary health institutions (State/Private university hospitals, training and research/city hospitals). Post-residency physicians may work in private hospitals, state hospitals, or tertiary healthcare institutions [20]. The reason why we draw special attention to residency and current institutes while measuring the level of knowledge and awareness about a current issue such as big data is the polycentricity and lack of standardization in neurosurgery training. While the residency institutes of the participants are mostly from state universities (56.9%), the current institute is the most common

Table 2. The descriptive data about survey participants

Variables		
Age (years), n (%)	24-29	4 (1.9)
	30-34	44 (20.9)
	35-39	56 (26.5)
	40-44	56 (26.5)
	≥45	51 (24.2)
Gender, n (%)	Male	191 (90.5)
	Female	20 (9.5)
The nature of residency institution, n (%)	State university	120 (56.9)
	Training and research/city hospital	83 (39.3)
	Private university	5 (2.4)
	Foreign country	3 (1.4)
Academic title, n (%)	Specialist	130 (61.6)
	Assistant professor	31 (14.7)
	Associate professor	37 (17.5)
	Professor	13 (6.2)
The presence of PhD degree, n (%)	No	193 (91.5)
	Yes	18 (8.5)
Professional specialist period (years), n (%)	1-4	67 (31.8)
	5-8	53 (25.1)
	9-12	50 (23.7)
	13-16	14 (6.6)
	>16	27 (12.8)
The nature of current institution, n (%)	State hospital	48 (22.7)
	State university	47 (22.3)
	Training and research/city hospital	70 (33.2)
	Private hospital	33 (15.6)
	Private university	9 (4.3)
	Foreign country	4 (1.9)
The use of big data platform in daily practice, n (%)	No	188 (89.1)
	Yes	23 (10.9)
The code writing, n (%)	No	185 (87.7)
	Yes (one time)	17 (8.1)
	Yes (two times)	2 (0.9)
	Yes (more than three times)	7 (3.3)
I think big data platforms are useful in neurosurgery practice, n (%)	No	6 (2.8)
	Yes	86 (40.8)
	I have no idea	119 (56.4)
The desire to learn more about big data, n (%)	No	35 (16.6)
	Yes	176 (83.4)
Survey score	Mean±SD	27.91±23.99
	Median (Min.-Max.)	20.00 (0.00-80.00)

training and research/city hospital (33.2 %). These rates support the conclusion that these institutions, which we stated in our previous study [20], are more scientifically active. In the question about whether the code was written on the big data platform, the survey score of the people who wrote the most code was expected to be the highest, while the code score was determined to be the highest two times. This is possible because coding is a team effort and not everyone on the team can be at the same level of knowledge.

Table 3. The comparison of survey score with categories of demographic variables

Variables		Survey score		P value
		Mean±SD Median	Mean±SD Median	
Age (years), n(%)	24-29	45.00±10.00	50.00 (30.00-50.00)	0.585[b]
	30-34	26.14±22.12	20.00 (0.00-70.00)	
	35-39	26.61±26.03	10.00 (0.00-80.00)	
	40-44	29.46±24.45	20.00 (0.00-80.00)	
	≥45	27.84±23.61	30.00 (0.00-70.00)	
Gender, n (%)	Male	28.06±24.19	20.00 (0.00-80.00)	0.986[a]
	Female	26.50±22.54	20.00 (0.00-70.00)	
The nature of residency institution, n (%)	State university	26.92±23.86	20.00 (0.00-80.00)	0.544[b]
	Training and research/city hospital	28.31±23.88	30.00 (0.00-70.00)	
	Private university	42.00±21.68	50.00 (10.00-60.00)	
	Foreign country	33.33±40.41	10.00 (10.00-80.00)	
Academic title, n (%)	Specialist	24.85±23.10	15.00 (0.00-80.00)	0.065[b]
	Assistant professor	34.52±23.78	40.00 (0.00-80.00)	
	Associate professor	32.70±25.46	20.00 (0.00-70.00)	
	Professor	29.23±26.29	30.00 (0.00-70.00)	
The presence of PhD degree, n (%)	No	27.77±24.17	20.00 (0.00-80.00)	0.781[a]
	Yes	29.44±22.61	35.00 (0.00-60.00)	
Professional specialist period (years), n (%)	1-4	26.42±22.74	20.00 (0.00-80.00)	0.276[b]
	5-8	23.02±23.00	10.00 (0.00-70.00)	
	9-12	32.80±25.80	30.00 (0.00-80.00)	
	13-16	33.57±26.49	50.00 (0.00-70.00)	
	>16	29.26±23.52	30.00 (0.00-70.00)	
The nature of current institution, n (%)	State hospital	21.25±21.10	15.00 (0.00-70.00)	0.113[b]
	State university	32.55±23.73	40.00 (0.00-80.00)	
	Training and research/city hospital	26.00±24.10	15.00 (0.00-70.00)	
	Private hospital	32.12±24.84	40.00 (0.00-70.00)	
	Private university	33.33±26.46	20.00 (0.00-70.00)	
	Foreign country	40.00±35.59	35.00 (10.00-80.00)	

Mean:Mean, SD:Standard Deviation, Min:Minimum, Max:Maximum, a:Mann-Whitney U test, b:Kruskal Wallis H test

Table 4. The comparison of survey score with interest and skills in big data

Variables		Survey score		P value
		Mean±SD	Median (Min.-Max.)	
The use of big data platform in daily practice, n (%)	No	25.53±23.41	20.00 (0.00-80.00)	<0.001[a]
	Yes	47.39±19.82	50.00 (0.00-70.00)	
The code writing, n (%)	No	26.00±23.60	20.00 (0.00-80.00)	0.008[b]
	Yes (one time)	45.88±22.65	50.00 (0.00-80.00)	
	Yes (two times)	50.00±0.00	50.00 (50.00-50.00)	
	Yes (more than three times)	28.57±22.68	30.00 (0.00-60.00)	
I think big data platforms are useful in neurosurgery practice, n (%)	No	46.67±25.03	55.00 (0.00-70.00)	<0.001[b]
	Yes	47.09±17.48	50.00 (0.00-80.00)	
	I have no idea	13.11±16.45	10.00 (0.00-80.00)	
The desire to learn more about big data, n (%)	No	20.29±21.76	10.00 (0.00-70.00)	0.048[a]
	Yes	29.43±24.18	30.00 (0.00-80.00)	

Mean:Mean, SD:Standard Deviation, Min:Minimum, Max:Maximum, a:Mann-Whitney U test, b:Kruskal Wallis H test

While evaluating frequently performed surgeries worldwide, single-center studies do not provide sufficient statistical power to make a general judgment (18). In addition, due to the nature of single-center studies, these studies reflect the experiences of a small number of surgeons (12). Samaga et al. (23) suggested the use of multi-center datasets instead of single-center since the most important priority when making therapeutic decisions would be to minimize the prediction error. Thus, consensus can be reached with the big data provided by the data sets (18). Big data analyses published in all areas of neurosurgery (2,8,9,10-18) provide useful advice to clinicians by examining large specific patient groups. There are also publications (24) that the big data model does not provide answers to questions about complex neurosurgical procedures. The concern of these authors is that manipulation of databases is highly possible (24). Although not accurate for a single patient, they can provide a zoom-out and abstract perspective that cannot be detected without evaluating a large patient group. However, they do not have zoom-in capabilities on a particular observation or question that emerges from an analysis.

Globally, many patients in low- and middle-income countries do not have access to life-saving neurosurgical procedures. Assessing the overall burden of neurosurgery disease, planning cost-effective improvements in access to neurosurgical care, and collecting information on conditions that are rare in developed countries are potential applications of big data in neurosurgery (25).

As neurosurgeons who have always pioneered innovation in the medical community, we are experiencing an analytical revolution that threatens to be caught unprepared to examine and evaluate the patient data we collect. It is our responsibility to use new techniques of modern data science to improve our practices and the quality of life of our patients (21).

CONCLUSION

The knowledge level and awareness of big data are not related to any baseline characteristics for Turkish neurosurgeons. Obtaining information about big data is only associated with personal interests. In today’s world, where traditional data has evolved into big data and given direction to clinical approaches, the training of neurosurgeons should be given importance in this regard.

Ethical approval: This study is an online survery and does not need ethical approval.
Conflict of interest: There is no conflict of interest in our study.
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Research Article / *Araştırma Makalesi*

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Sinir Sistemi Cerrahisi Derneği

The Effects of Dexamethasone Used in the Treatment of Chronic Subdural Hematoma

Kronik Subdural Hematom Tedavisinde Deksametazonun Etkileri

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ABSTRACT

Aim: In this study, we aimed to analyze the properties of drained subdural fluid and post-operative follow-up of patients with chronic subdural hematoma subdivided randomly into two groups according to presence or absence of dexamethasone treatment.
Material and Methods: 42 patients with chronic subdural hematoma were involved in this study. The patients were divided into two groups according to dexamethasone treatment. 21 of the patients were treated with dexamethasone. All patients underwent burr hole craniotomy and a closed system drainage was constructed. The amount and properties of per-operative versus post-operative drained subdural fluid (hemoglobin, total protein and albumin levels) were analyzed. Cranial computerized tomography scans were used for follow-up and presence of fluid collection in subdural space was controlled.
Results: When compared to per-operative laboratory results, statistically significant decrease was observed in both groups. However, the decrease in dexamethasone group was more significant compared to none-dexamethasone group. Follow-up computerized tomography results showed rare new subdural fluid collection development in dexamethasone group.
Conclusion: As a result, Our findings suggest that surgery with dexamethasone treatment in chronic subdural hematoma patients has a more favourable clinic result compared to surgery without dexamethasone treatment.

Keywords: Chronic subdural hematoma, subdural hematoma, dexamethasone, steroid treatment

ÖZ

Amaç: Bu çalışmada amacımız kronik subdural hematomlu hastalarda randomize olarak seçilen tedavide kullanılan deksametazon alan hastalar ve deksametazon almayan hastaların drene olan mayinin özelliklerinin karşılaştırılması ve postoperatif seyirlerinin takibidir.
Yöntem ve Gereç: Çalışmamızda 42 kronik subdural hematomlu hastanın takip ve tedavisi yapıldı. Bu hastaların 21'ine deksametazon tedavide verildi, 21 hastaya ise deksametazon tedaviye eklenmedi. Her iki hasta grubuna operasyonda burr-hole kraniotomi uygulandı ve kapalı drenaj sistemi oluşturuldu. Operasyon sırasında

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alınan ve sonrasında alınan kavite materyalinin özellikleri (mayide hemoglobin, total protein ve albümin düzeyleri) ve drene olan mayi miktarı karşılaştırıldı. Bu hastaların takiplerinde kranial bilgisayarlı tomografi çekildi. Hastalarda kontrol tomografilerinde subdural aralıkta kolleksiyon olup olmadığı kontrol edildi.
Bulgular ve Sonuç: Her iki hasta grubumuzda operasyonda alınan örneklerle karşılaştırıldığında kendi içlerinde anlamlı düşüşler tespit edildi. Ancak deksametazon kullanılan hasta grubumuzda düşüşler deksametazon almayan hasta grubumuzla karşılaştırıldığında azalma deksametazon alan hasta grubu lehine anlamlı olmuştur.

Anahtar Kelimeler: Kronik subdural hematom, subdural hematom, deksametazon, steroid tedavisi

INTRODUCTION

The head trauma, which has become one of the most important problem in our time; is a pathology that requires long-term treatment and care and can be fatal, can cause disabling, and ranks 4th among the causes of death. Traffic accidents, falls, beatings, work accidents, and injuries occurred during sports or at home creates the main causes of head trauma. The relative frequency of each cause varies according to different age groups and between regions.

The collection of blood in the subdural space between the dura mater and arachnoid membrane called subdural hematoma (SDH). SDHs can be classified as acute, subacute, and chronic according to torn vessel size, shape hematoma development and more importantly, formed by the interest rate and severity of the signs and symptoms [1]. *Acute Subdural Hematoma* refers to bleeding in the subdural space after the early phase (first 72 hours) of the trauma. Subacute Subdural Hematoma refers to the subdural hemorrhage collected between 3 days-3 weeks. However, these lesions are generally behave clinically like acute or chronic hematoma. *Chronic Subdural Hematoma* refers to bleeding detected after the 3rd week.

Originally, chronic subdural hematoma (cSDH) first defined by Virchow "Pachymeningitis haemorrhage of interna" in 1857. Despite being a frequently encountered types of intracranial hemorrhage, the pathogenesis is still unclear. CSDH is a collection between the dura and arachnoid. It is developing a capsule in cSDH and hematoma is trapped in the capsule.

The main problem is how the hematoma grows? [2]. The most commonly accepted theory for today is the theory of recurrent bleeding that result of hyper fibrinolysis of the macro capillaries in outer membrane of chronic subdural hematoma, or increased levels of plasmin compared to antiplasmin [3,4].

The initial factors of cSDH can be both of subdural hemorrhage or parainfectious. Subdural blood accumulation in the beginning is often traumatic. This results from injury caused by parasaggital bridge veins acceleration after direct or indirect cranial trauma. Skull fracture and consequent damage to some neighboring stand may result in a subdural hematoma causing a laceration in the venous sinuses. Nontraumatic origins of subdural blood and fibrin accumulation included AVMs of convexity, other cerebrovascular lesions and the aneurysm, bleeding diathesis, the infectious disease, brain tumors, especially convexity meningioma, meningeal carcinomatosis and sarcomatosis [5-8].

To summarize the physiopathogenesis of cSDH development; cSDH starts with subdural hemorrhage, a membrane that outer portion of it containing many abnormal blood vessels acts like a capsule and wraps the blood.

Local hyperfibrinolysis causes subdural hematoma liquefaction, cleavage products increase the bleeding by causing recurrent microhaemorrhages from peripheral vascular membrane and causes hematoma growth.

CSDH symptoms and signs are variable and are not pathognomonic. Clinical manifestations include headache, nausea, vomiting, imbalance in local progressive neurological deficits and the slow-growing mass lesions or symptoms may resemble dementia in older patients. The most common symptoms; headache, mental changes and hemiparesis. Headache occurs in 30-90% of patients. Headaches can be mild or generalized [9].

Chronic subdural hematoma diagnosis is based on the clinician's ability to understand and suspicion. Because cSDH can be presented in many different ways to complicate clinical diagnosis. Brain Tomography (CT) is the first diagnostic tool in the diagnosis of the CSDH because it is quite effective and non-invasive. CSDH can be diagnosed by CT accurately and quickly. When radiographic imaging considered for cSDH, it should be remember that there is not a clear correlation between hematoma size and clinical sings and symptomps. Therefore, selection of patients for surgical treatment based on clinical findings other than radiographic criteria.

CSDH can be treated as medical, surgical or both medical surgery.

Medical treatment of cSDH: post-traumatic and post-operative prophylaxis of seizures, and for preventing edema and ischemia. Anticonvulsant agents can be cut off after a few weeks if postoperative seizures do not appear at all.

Surgical treatment: Surgery has been shown to be most effective in the treatment cSDH The evacuation of subdural collections form the basis of the surgery in cSDH [10-12].

Craniotomy and capsule resection method, burr-hole method, twist drill method, fontanel tapping method, peritoneal shunt or cardiac catheter with an internal method, permanent subcutaneous reservoir subdural resist are a number of different surgical techniques [13].

After treatment, residual subdural fluid collections are common. The most important and dangerous complications of surgical treatment of acute postoperative bleeding. Infectious complications such as subdural empyema, brain abscess and meningitis can occur. These are rare and are between 1.5 to 4.2% (14). Epilepsy has been reported in approximately 10% of patients and all patients with cSDH should receive prophylactic anti-convulsant therapy before surgery. If seizures are not seen in 1 month postoperatively, treatment can be terminated [14].

In this study; we aimed to show the impact of CSDH expansion and re-accumulation of hematoma by measuring the penetration of 99mTc-human albumin complex into the hematoma cavity which is an indirect method. For this purpose, features of the fluid drains from subdural cavity were observed in a total of 42 patients with cSDH and treated and followed by our clinic. These patients underwent control CT and evaluated. In these patients, the effects of dexamethasone on the fluids drained and impact on recurrence-residual disease was observed.

MATERIAL AND METHODS

In this study, 42 patients were treated and evaluated who diagnosed with chronic subdural hematoma and admitted the Neurosurgery Clinic of Okmeydani Training and Research Hospital between January 2004 and March 2010. The diagnosis of all patients was confirmed by computed tomography. 21 randomly selected patients with chronic subdural hematoma were started on dexamethasone, and the other 21 patients were not given dexamethasone. The hemoglobin, total protein and albumin levels were determined in sample of chronic subdural hematoma cavity taken during the operation, and the fluid drained from the operation area. The amount of fluid that drains was measured daily.

The patients were operated under general anesthesia. The burr-hole craniotomy method was applied to all patients. Skin incisions opened according to the localization of the hematoma and the way to match the flap removal. Burr-hole opened in accordance with 2.5cm in diameter hematoma localization. Paying attention to hemostasis, chronic subdural hematoma opened dura mater plus incision in a way that will not damage the outer membrane. Burr hole was burned to the bone boundary with bipolar. Chronic subdural hematoma fluid was taken two syringes in a way will not contaminated with blood samples. There was inner and outer membrane of hematoma in all chronic subdural hematoma patients who received surgery. The cavity was irrigated with serum physiological with drains placed in the chronic subdural hematoma cavity. Each burr hole by placing a drain connected to the glove off the end of the drainage system. In this closed system, the amount of the daily drain may have been identified and sampled.

The fluid samples taken from chronic subdural hematoma cavity during and after the operation were studied in terms of and hemoglobin, total protein and albumin levels in biochemistry and microbiology laboratories. After the operation, the amount of drained from the drain of the patients which chronic subdural hematoma were measured.

The computed tomography was used for the diagnosis of patients. By using the Yamashima classification [15], hematomas were divided into five different types according to the CT appearance as hyperdense, hypodense, isodense, mixed-density and layered (layering).

The computed tomography was used in the postoperative 1st and 3rd month for following patients with chronic subdural hematoma.

Markwalder neurological classification was used in the clinical classification of patients with chronic subdural hematoma (Table 1).

Statistical analysis

SPSS 16 (statistical package for social sciences) for Win7 and Office2007 was used for evaluating statistically the data obtained in this study. Data were analyzed using descriptive statistical methods as well as the Mann-Whitney U and paired sample t test (paired t test) were used. Results at 95% confidence interval and the $p<0.005$ level is evaluated.

RESULTS

1) Albumin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the albumin levels in fluids. Figure 1 shows that these differences are decreasing direction ($p<0.05$).

Table 1: Markwalder's Grades of Chronic Subdural Hematoma

Grade 0: Patient neurologically normal
Grade 1: Patient alert and oriented; mild symptoms, such as headache; absent or mild symptoms or neurologic deficit, such as reflex asymmetry
Grade 2: Patient drowsy or disoriented with variable neurological deficit, such as hemiparesis
Grade 3: Patient stuporous but responding appropriately to noxious stimuli; several focal signs, such as hemiparesis
Grade 4: Patient comatose with absent motor response to painful stimuli; decerebrate or decorticate posturing

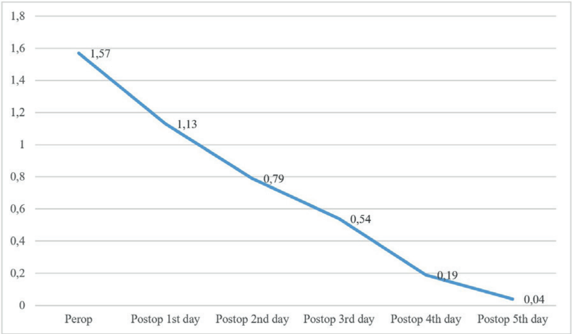

Figure 1. Change in Mean Albumin Levels in Fluids in İntraoperative And Postoperative Periods

2) Total Protein Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the total protein levels in fluids ($p<0.05$). Figure 2 shows that these differences are decreasing direction.

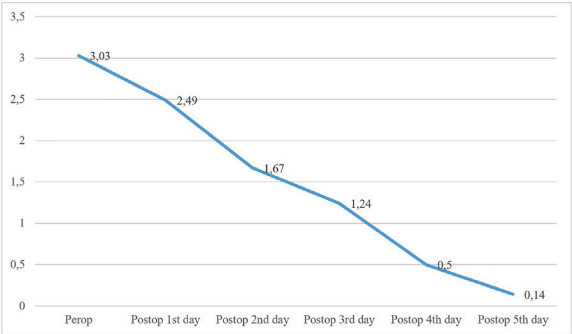

Figure 2. Change in Mean Total Protein Levels in Fluids in İntraoperative And Postoperative Periods

3) Hemoglobin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the hemoglobin levels in fluids ($p<0.05$). Figure 3 shows that these differences are decreasing direction.

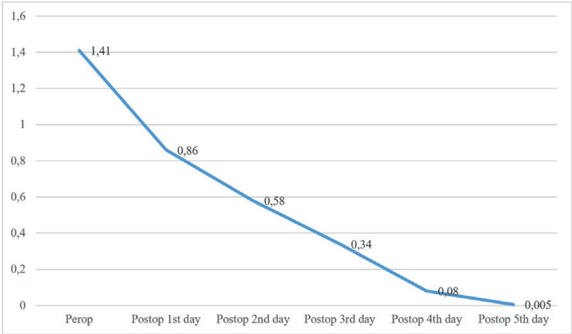

Figure 3. Change in Mean Hemoglobin Levels in Fluids in Intraoperative And Postoperative Periods

4) Amount Fluid Daily Drains

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the amount fluid daily drains levels ($p<0.05$). Figure 4 shows that these differences are decreasing direction.

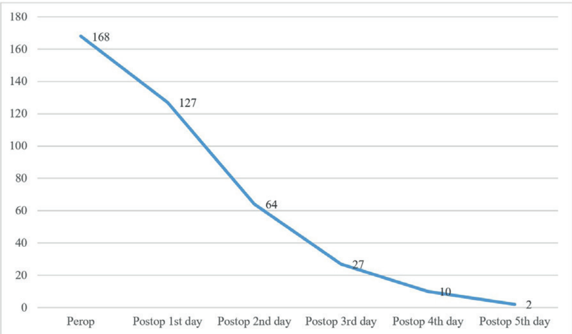

Figure 4. Change in Fluid Amount Daily Drains in Intraoperative And Postoperative Periods

Paired t test Analysis (Without Dexamethasone)

1) Albumin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the albumin levels in fluids ($p<0.05$). Figure 5 shows that these differences are decreasing direction.

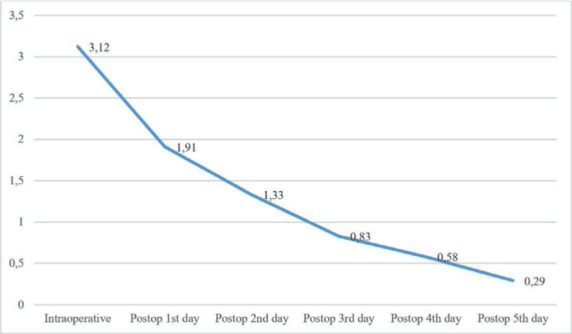

Figure 5. Change in Mean Albumin Levels in Fluids in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

2) Total Protein Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the total protein levels in fluids ($p<0.05$). Figure 6 shows that these differences are decreasing direction.

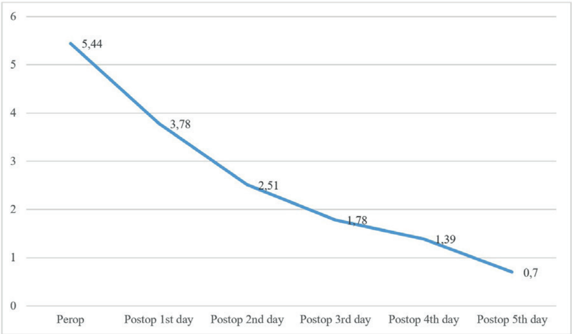

Figure 6. Change in Mean Total Protein Levels in Fluids in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

3) Hemoglobin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the hemoglobin levels in fluids ($p<0.05$). Figure 7 shows that these differences are decreasing direction.

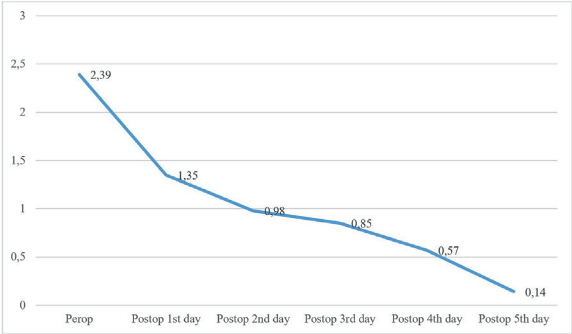

Figure 7. Change in Mean Total Hemoglobin Levels in Fluids in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

4) Fluid Amount Daily Drains

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the fluid amount daily drains levels ($p<0.05$). Figure 8 shows that these differences are decreasing direction.

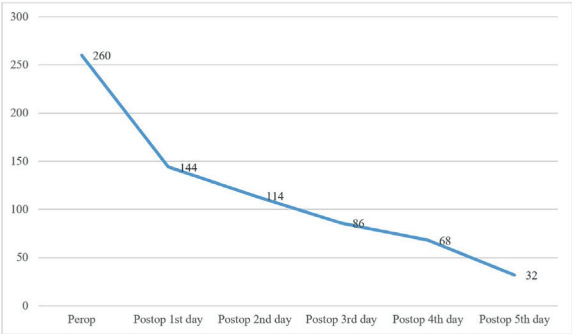

Figure 8. Change in Amount Fluid Daily Drains in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

Comparative Analysis

1) Albumin Levels

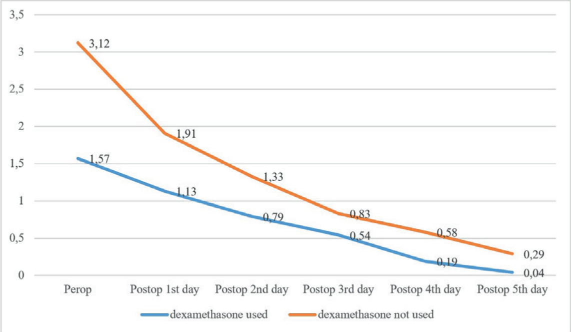

Figure 9. Average Albumin Levels in Fluids Taken From Patients Dexamethasone Used and Dexamethasone not Used

Figure 9 considering that; the average levels of albumin in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of albumin levels in the fluid taken intraoperatively ($p<0.05$). However, there was no difference for 1st, 2nd and 3rd day in terms of albumin levels in fluids between two groups dexamethasone used and not used. There was a significant difference again for 4th day and 5th day after the operation ($p<0.05$).

2) Total Protein Levels

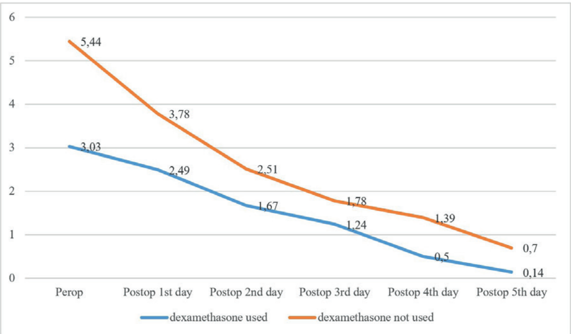

Figure 10. Average Total Protein Levels in Fluids Taken From Patients Dexamethasone Used and Dexamethasone not Used

As shown in Figure 10; the average levels of total protein in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of total protein levels in the fluid taken intraoperatively ($p<0.05$). However, there was no difference for 1st, 2nd and 3rd day in terms of total protein levels in fluids between two groups dexamethasone used and not used. There was a significant difference again for 4th and 5th days after the operation ($p<0.05$).

3) Hemoglobin Levels

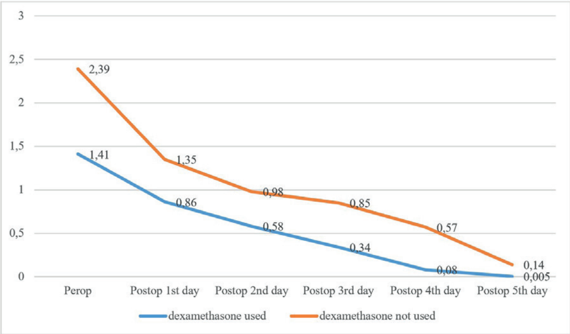

Figure 11. Average Hemoglobin Levels in Fluids Taken From Patients Dexamethasone Used and Dexamethasone not Used

Figure 11 shows that the average levels of hemoglobin in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of hemoglobin levels in the fluid taken intraoperatively, and 1st, 2nd, 3rd, 4th and 5th days after the operation ($p<0.05$).

4) Fluid Amount Daily Drains

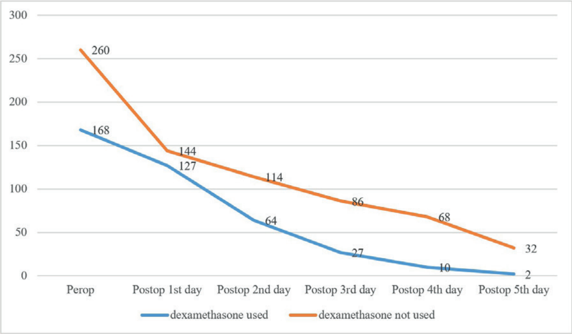

Figure 12. Fluid Amount Daily Drains in Patients Dexamethasone Used and Dexamethasone not Used

Figure 12 shows that the average levels of fluid amount daily drains in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of fluid amount daily drains taken intraoperatively, and 2nd, 3rd, 4th and 5th days after the operation ($p<0.05$). Only postoperative day 1, fluid amounts were similar for both groups.

Tomography Findings

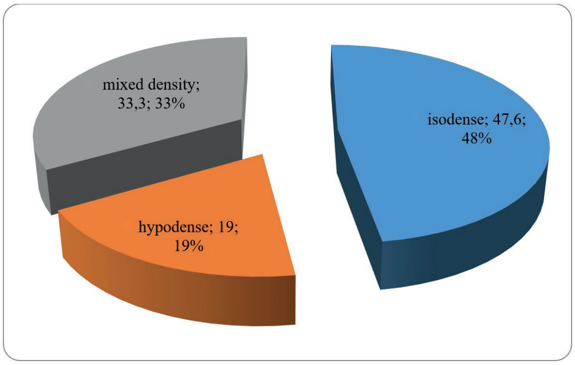

Figure 13. On the CT scan, isodensity was detected in 48%, mixed density was in 33% and hypodensity was in 19% of patients in the dexamethasone used group. Hyperdense and layering condition was not observed in these patients.

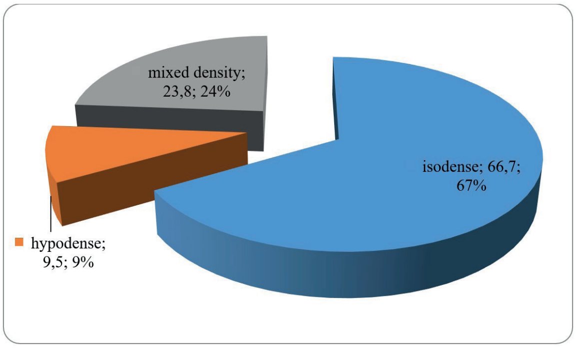

Figure 14. On the CT scan, isodensity was detected in 67%, mixed density was in 24% and hypodensity was in 9% of patients in the dexamethasone not used group. Hyperdense and layering condition was not observed in these patients.

DISCUSSION

Chronic subdural hematoma is a type of intracranial hemorrhage frequently encountered in brain surgery, but the pathophysiology has not been fully clarified [12,16-18].

Several ideas have been proposed about growth of hematoma. 150 years ago, Bayle reported that chronic bleeding causes the growth of subdural hematoma. Putnam and Cushing, Dandy, Apfelbarum et al. reported that chronic subdural hematoma expansion is caused by the recurrent bleeding from the capsule of hematoma [19-21].

The recurrent bleeding theory as a result of increased levels of plasmin from macro-capillary of the outer membranes of chronic subdural hematoma is the most accepted theory for today [3,4].

In the literature, it was indicated that microcapillary in outer membrane of chronic subdural hematoma is extremely permeable, this structures not or partly containing basement membrane and containing gap junctions, cause the plasma leakage into the hematoma. As a result, it was reported that exudation and transudation via macrocapillary can play an important role in expansion of chronic subdural hematoma.

More recently, local hyperfibrinolysis in outer membrane has been reported as major etiological factor of chronic subdural hematoma [3,8,22].

According to the Markwalder neurological grade, 14 patients were identified as grade 1 and 7 patients were grade 2 in patients dexamethasone used. Similarly, 15 patients were identified as grade 1 and 6 patients were grade 2 in patients dexamethasone not used.

The average age of our patients was 59.9 in patients dexamethasone used, and was 63.2 in patients dexamethasone not used.

As showed in Figure 13 and 14; On the CT scan, isodensity was detected in 48%, mixt density was in 33% and hypodensity was in 19% of patients in the dexamethasone used group. Similarly, isodensity was detected in 67%, mixt density was in 24% and hypodensity was in 9% of patients in the dexamethasone not used group. Hyperdense and layering condition was not observed in both of groups.

Unilateral chronic subdural hematoma was detected in 20 patients and bilateral chronic subdural hematoma was in 1 patient in the patients dexamethasone used. On the other hand; 18 patients have unilateral, and 3 patients have bilateral chronic subdural hematoma in dexamethasone not used group.

The control tomography had taken at 1st and 3rd month after the operation in these patients. The collection was re-detected in 11 patients dexamethasone not used in the control tomography results. Based on clinical condition, 3 patients were reoperated. Unlike, in the dexamethasone used group, the collection was observed in 3 patients in the control tomography results. Based on the clinical condition, none of these patients was operated. Dexamethasone that dose reducted and cutted was added to the treatment again, and the patients were followed up. The collection was not detected again in 3 patients in the control tomography.

The reduction of total protein and albumin levels in the fluids followed daily from the closed drainage system was statistically significant in patients dexamethasone not used ($p<0.05$). Similarly, the decrease in total protein and albumin levels were significantly in the patients dexamethasone used. The reduction of these two groups was compared. There was no significant difference in the first days after the operation, but it has become significantly after the 3rd day after the operation. Possible reasons are that the reduction of amount drained and quicker terminated closed drainage system in some patients dexamethasone used.

The hemoglobin levels were measured in samples of cavity taken during operation and daily fluids draining from the cavity after operation in patients dexamethasone not used. It was detected that the reduction of hemoglobin levels was statistically significant ($p<0.05$). This reduction was observed similarly in patients dexamethasone used.

When two groups compared, the observed decrease in hemoglobin for p-value levels in patients dexamethasone used was found to be more meaningful.

When the amount of fluids that drain from the cavity to the closed drainage system after operation compared on a daily basis (with paired samples t test), p-value was found significant in terms of reduction of the amount drained both in patients dexamethasone not used and dexamethasone used ($p<0.05$).

CONCLUSION

In this study; the number of patients seen collections in the control tomography was more in the group dexamethasone not used, and some patients required re-surgery in this group. However, the number of patients seen collections in the control tomography was so less in the group dexamethasone used and no patient required re-surgery. The amount of fluid is drained from the cavity was statistically significant less in dexamethasone use group compared the dexamethasone not used group ($p<0.05$).

Consequently, the use of dexamethasone in patients with chronic subdural hematoma reduce the amount of accumulation of fluids and therefore recurrence-residue risk is also being reduced.

Conflict of interest: There is no conflict of interest in our study.
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Research Article / *Araştırma Makalesi*

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The Role of Unilateral Hemilaminectomy in Benign Intradural Spinal Tumor Surgery

Benign İntradural Spinal Tümör Cerrahisinde Unilateral Hemilaminektominin Rolü

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ABSTRACT

Objective: Hemilaminectomy can be used to treat different space-occupying lesions, whether intradural, extramedullary, intramedullary, or extradural. In this study, We have investigated to illuminate the role of hemilaminectomy in benign spinal cord tumors, which occupy the spinal canal.
Materials and Methods: 15 patients with spinal tumors who were operated on with hemilaminectomy were included in the evaluation. The hemilaminectomy method was chosen based on the size, laterality, number of segments involved, and possible pathologies. The demographics of the subjects, as well as their operating reports, histological results, pre- and postoperative images, and follow-up information, were examined. Frankel grade classification was used to assess the neurological status on admission and during follow-up.
Results: The mean age of the patients was 48.4 years. Nine of the patients were male and 6 were female. According to tumor localization, 3 of them were cervical, 7 were thoracic, and 5 were lumbar. 4 of them were meningiomas, 6 were ependymomas, and 5 were schwannomas. One patient was worse than the pre-operative, and the post-operative grades of the remaining 11 patients were similar to the pre-operative grades. Post-operative imaging showed that gross-total resection was achieved in all patients.
Conclusion: If used correctly and with a reasonable learning curve, limited unilateral hemilaminectomy can offer enough access to the dural sac, allowing for safe resection of nearly all spinal intradural and extradural lesions. Because it takes less time to operate than a standard laminectomy, it is better for older or high-risk patients.

Keywords: Spinal tumor, hemilaminectomy, Frankel

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ÖZ

Amaç: Hemilaminektomi intradural, ekstramedüller, intramedüller veya ekstradural olsun farklı yer kaplayan lezyonların tedavisinde kullanılabilir. Bu çalışmada, spinal kanalı işgal eden iyi huylu omurilik tümörlerinde hemilaminektominin rolünü aydınlatmaya çalıştık.
Gereç ve Yöntem: Değerlendirmeye hemilaminektomi ile opere edilen spinal tümörlü 15 hasta dahil edildi. Hemilaminektomi yöntemi boyut, lateralite, tutulan segment sayısı ve olası patolojilere göre seçildi. Deneklerin demografik özellikleri, operasyon raporları, histolojik sonuçları, ameliyat öncesi ve sonrası görüntüleri ve takip bilgileri incelendi. Başvuru ve takip sırasında nörolojik durumu değerlendirmek için Frankel sınıflaması kullanıldı.
Bulgular: Hastaların ortalama yaşı 48.4 idi. Hastaların 9'u erkek, 6'sı kadındı. Tümör lokalizasyonuna göre 3'ü servikal, 7'si torasik ve 5'i lomberdi. 4'ü meningiom, 6'sı ependimom ve 5'i schwannom idi. Bir hastanın postoperatif Frankel skoru preoperatife göre daha kötüydü, kalan 11 hastanın ise postoperatif skorları preoperatiflere benzerdi. Postoperatif görüntülemeler, tüm hastalarda gros-total rezeksiyona ulaşıldığını gösterdi.
Sonuç: Doğru ve makul bir öğrenme eğrisi ile kullanılırsa, sınırlı tek taraflı hemilaminektomi dural keseye yeterli erişim sağlayarak neredeyse tüm spinal intradural ve ekstradural lezyonların güvenli rezeksiyonuna izin verebilir. Standart bir laminektomiden daha az zaman aldığından, daha yaşlı veya yüksek riskli hastalar için daha iyidir.

Anahtar Kelimeler: Spinal tümör, hemilaminektomi, Frankel

INTRODUCTION

Spinal tumors are uncommon and occur in 1-2.5 persons per 100,000. Intradural spinal cord tumors are typically accessible by laminectomy, which allows for better vision. Interlaminar fenestration, laminotomy, and hemilaminectomy (HL) have also been used. Apart from full resection, pre-morbid, preoperative, and postoperative general clinical condition, tumor grade, and location are all predictors of surgical outcomes [1-3]. The goal is to do a thorough resection with minimally invasive procedures while minimizing iatrogenic damage that might result in postoperative problems [3-5]. Although laminectomy provides appropriate exposure, it has been associated with postoperative problems such as hematoma development, spinal deformity, dural constriction owing to epidural scarring, and restricted access in the event of reoperation, all of which can result in a poor outcome. To replace laminectomy and reduce the risk of postoperative instability and deformity, less invasive techniques have been used. Bickham [6] described osteoplastic laminotomy, which was used by Raimondi [1] and Parkinson [7]. It has also been advised that a decompressive laminectomy be performed first, followed by fusion [2]. In 1991, Yasargil et al presented a study on a group of 100 patients who were treated with HL for spinal tumors or arteriovenous malformations [8]. Bertanalfy proposed in 1992 that for removal of extramedullary lesions arising in the spinal canal, HL combined with microsurgical methods should be preferred to simple laminectomy. Following that, HL has been used to treat different space-occupying lesions, whether intradural, extramedullary, intramedullary, or extradural [4,9-11]. In this retrospective study, we investigate the profiles of spinal cord tumors that could be removed through a unilateral HL. We would like to illuminate its role in benign spinal cord tumors, which occupy the spinal canal. Some technical tips on overcoming the narrow surgical corridor are also discussed.

MATERIALS AND METHODS

Patient Population

Fifteen patients who underwent minimally invasive HL surgery due to spinal lesion were included in this study. The HL method was chosen based on the size, laterality, number of segments involved, and possible pathologies. The demographics of the subjects, as well as their operating reports, histological results, pre- and postoperative images, and follow-up information, were examined. Frankel grade classification was used to assess the neurological status on admission and during follow-up [12]. Preoperative dynamic X-rays were used to assess possible instability; preoperative CT scans were used to determine whether the intervertebral foramen was enlarged or not; contrast-enhanced MRI was used to show the side, size, and location of the suspected tumor in all cases; and magnetic resonance angiography was used to determine the relationship between the tumor and the vertebral artery in cervical spinal cord lesions. A postoperative MRI was used to evaluate the extent of the lesion excision.

Surgical Technique

Preoperative steroids were given starting one day before surgery and continuing up to three days thereafter. The night before the surgery, X-Ray imaging or MRI was obtained to properly pinpoint the levels involved.

The patient was intubated in the operating room. Electrophysiologic monitoring was performed using MEP and SEP electrodes. Transcranial electrical stimulation of the motor cortex was used to record MEPs, with the stimulating electrodes implanted on the scalp (hand or leg area). The external anal sphincter, as well as the abdomen of the muscles of the upper and lower limbs, were used as recording electrodes.

The tumor level was determined using the C-arm after the patient was placed in a prone posture. Following the procedures utilized for unilateral HL or discectomy, a midline skin incision was made, followed by unilateral subperiosteal muscle dissection and lamina exposure. The dural sac was revealed by drilling the lamina, including the base of the spinous process while maintaining the facet joint. Before making a dural incision, intraoperative ultrasonography can help detect the lesion.

Because the surgical field is so narrow in unilateral HL, it poses a problem. We used several practical technological approaches to get around this. The combination of undercutting of the base of the spinous processes with concurrent oblique tilting of the operating table to the contralateral side provided an adequate view for the extradural and intradural procedures. The lateral dural tacking procedure, which involves tacking the ipsilateral dural border and suturing it at the base of the muscle or fascia at the facet joint rather than lifting or suspending it, was also used. Internal debulking or piecemeal resection helps in the dissection of solid tumors. Prior to resection, if a tumor had a cystic component, the cyst was punctured and aspirated. Cottonoids applied to the upper and lower poles helped to prevent blood clots from spreading too far down the spinal canal. Because of the narrow window, using an intraoperative ultrasonic aspirator was not useful. To avoid adhesions, a gelatin sponge was put on the subdural area before dural closure. After that, a 4-0 vicryl running suture was used to approximate the dural sac. The needle utilized was a non-cutting 3/8 of a circle 8 mm needle, which provides for easy movement in tight places without causing huge dural holes. The incision site was draped after the muscle layer, subcutaneous tissue, and skin were closed.

Patients were usually discharged on the second or third postoperative day after waking and ambulating within a few hours of surgery.

RESULTS

15 patients with spinal tumors who were operated on with HL between 2021-2022 were included in the evaluation. The mean age of the patients was 48.4 years. Nine of the patients were male and 6 were female. When these tumors were examined according to their localization, it was observed that they were distributed in 3 cervical, 7 thoracic, and 5 lumbar regions. Of these tumors, 9 were intradural extramedullary localized and 6 were intradural intramedullary localized. 4 patients had pre-operative neurodeficiency. When examined according to tumor pathologies, 4 meningiomas, 6 ependymomas, and 5 schwannomas were

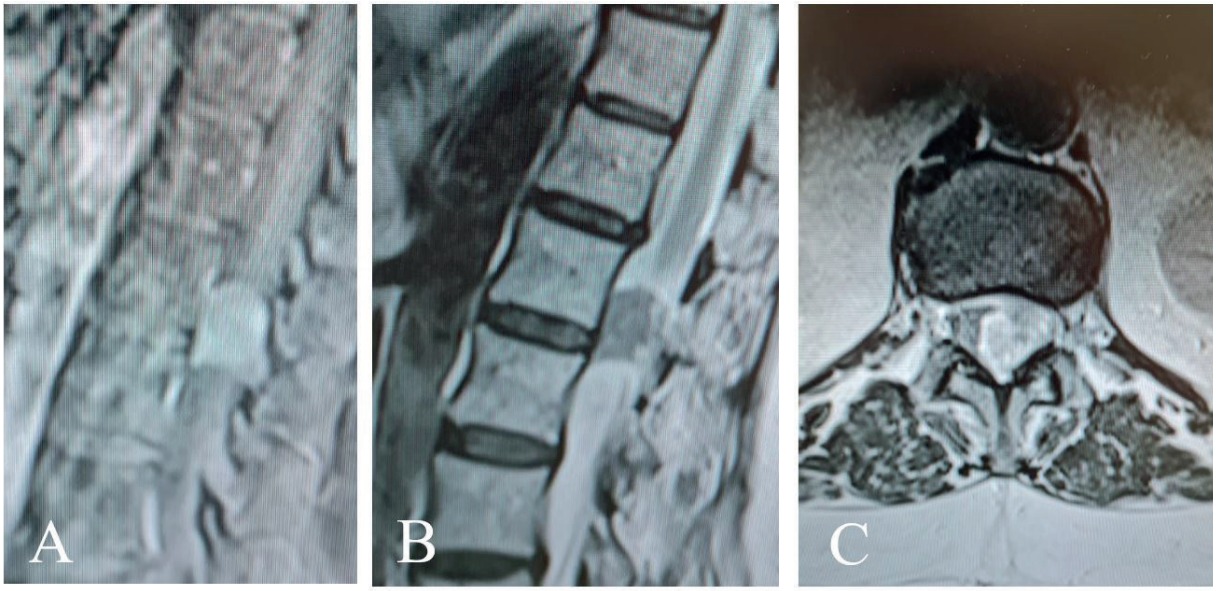

Figure 1. Preoperative MR images of a patient with thoracic schwannoma A. Sagittal Postcontrast T1 B. Sagittal T2 C. Axial T2

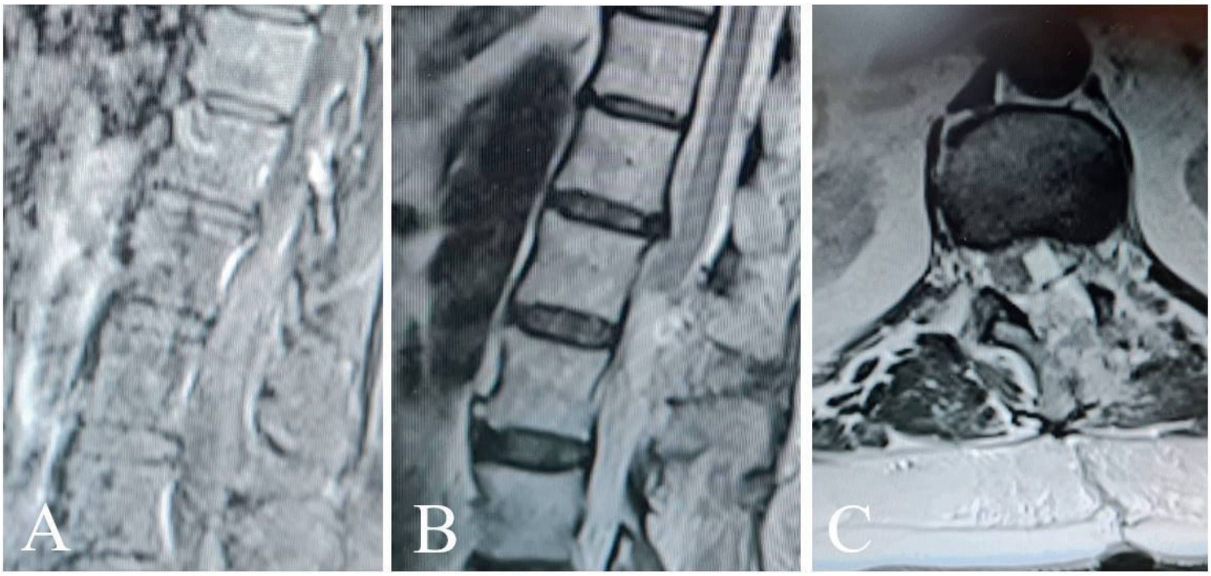

Figure 2. Postoperative MR images of a patient with thoracic schwannoma A. Sagittal Postcontrast T1 B. Sagittal T2 C. Axial T2

observed. Surgical decompression levels were 1 in 8 patients, 2 in 6 patients, and 3 in 1 patient, respectively. Pre-operative and post-operative Frankel grades of the patients were evaluated. The preoperative Frankel grades of the 15 patients were E in 11, D in 1, C in 2, and B in 1; postoperatively Frankel grades were E in 11 D in 3, and C in 1. It was observed that the post-operative Frankel grade of 3 patients was better than the pre-operative, One patient was worse than the pre-operative, and the post-operative grades of the remaining 11 patients were similar to the pre-operative grades. Post-operative imaging showed that gross-total resection was achieved in all patients (Table 1).

Table 1. Characteristics of operated patients

Number	Age	Sex	Symptom	Location	Level	Pathology	Pre-op Frankel	Post-op Frankel
1	36	M	Pain	Intramedullary	C2	Meningioma	D	C
2	25	F	Numbness, pain	Extramedullary	C3- C4	Meningioma	E	E
3	49	F	Pain	Intramedullary	C4- C5- C6	Ependymoma	E	E
4	64	F	Pain	Extramedullary	T7- T8	Meningioma	E	E
5	54	M	Numbness, pain	Extramedullary	T12	Ependymoma	E	E
6	61	F	Pain	Extramedullary	T2	Meningioma	E	E
7	66	M	Numbness, pain	Extramedullary	T1- T2	Schwannoma	E	E
8	55	F	Weakness, numbness	Intramedullary	T11	Ependymoma	C	D
9	57	M	Weakness, numbness	Extramedullary	T8-T9	Schwannoma	C	D
10	60	M	Weakness	Intramedullary	T1	Ependymoma	B	D
11	44	M	Pain	Intramedullary	L1- L2	Ependymoma	E	E
12	14	M	Pain	Intramedullary	L2-3	Ependymoma	E	E
13	66	F	Pain	Extramedullary	L3	Schwannoma	E	E
14	39	M	Pain	Extramedullary	L1	Schwannoma	E	E
15	36	M	Pain	Extramedullary	L4	Schwannoma	E	E

DISCUSSION

Bickham [(6)] was the first to describe osteoplastic laminotomy, and this procedure was advocated by Raimondi [(1)] and Parkinson [(7)] to lessen the danger of postlaminectomy spinal instability and deformity. Yasargil et al used HL in a series of malignancies and AVM patients in 1991 [(8)]. In 1992, Bertanalfy showed that, when compared to traditional laminectomy, HL coupled with microsurgical methods should be favored for extramedullary lesions [(13)]. Spetzger et al reported 3 intramedullary cavernoma who were treated by HL [(14)]. Sarıoglu et al performed unilateral HL on intradural extramedullary, intramedullary, and extradural malignancies, and observed no complications [(10,15)]. Oktem et al reported similar outcomes [(10,15)]. In patients with cervical spinal cord malignancies, Asazuma et al compared expanded open-door laminoplasty, standard laminectomy, and HL. In comparison to expansive open-door laminoplasty and traditional laminectomy, HL had a lower rate of cervical curvature type worsening. However, no significant difference in pre- and postoperative cervical curvature indices or range of motion was seen in either group [(9)]. Bian et al evaluated at 16 patients who had intramedullary cavernous malformations that were identified histologically. All of the patients had unilateral HL and tumor resection using microsurgery. During the follow-up period, none of the patients developed spinal deformity or instability [(11)]. The sagittal Cobb angle was assessed pre- and postoperatively following HL surgeries on extramedullary or extradural malignancies by Nagawa et al, and no significant deterioration was seen [(16)]. A modified HL was also done, with no signs of instability [(17,18)]. Iacogenelli et al. reported a series of 30 patients with intradural extramedullary spinal meningiomas who were at least 70 years old. They state that a less invasive method had the same probability of total tumor removal as a laminectomy or laminotomy group while offering a better postoperative course [(5)]. In 16 patients with thoracic intraspinal malignancies, Li et al performed in situ restorations of vertebral laminae to HL. They noted less postoperative problems, such as cerebrospinal fluid leakage, pseudomeningocele, spinal deformity, and instability, as a result of this surgery [(19)]. The biomechanical changes as a result of surgical alteration for treatment of intradural tumors at C3-6 using multilevel laminectomy, multilevel HL, and unilateral multilevel interlaminar fenestration with or without unilateral graded facetectomy were studied using a modified nonlinear finite element model of the intact cervical spine (C2-C7) developed by Xie et al. When compared to laminectomy, the less invasive techniques of unilateral multilevel interlaminar fenestration and multilevel HL substantially preserved the cervical spine's flexion motion (more than 48%), as well as the preserved motion and minimal risk of postoperative spinal instability [20,21]. In their research, Gu et al reported 16 patients with intradural extramedullary tumors who were treated with unilateral HL, mentioning limited invasion, decreased bleeding, and spinal stability as benefits of this technique [22]. For intraspinal malignancies, Millward et al compared laminectomy (34 patients) to HL (22 patients). There was no difference in time of surgery, resection completeness, complication rate, or Frankel-grade improvements. However, the HL group had a shorter post-operative stay, requires fewer analgesics, and has less post-operative kyphosis [23]. Pompili et al evaluated at 97 individuals who had an intradural extramedullary tumor and were operated on with a restricted HL approach. No patient required external bracing due to early or late spinal deformity or instability [24].

If performed properly and with a reasonable learning curve, limited unilateral HL can provide adequate access to the dural sac, allowing for safe excision of nearly all intraspinal lesions.

Since we started performing unilateral HL for the removal of spinal cord tumors, we have successfully removed all consecutive cases of spinal cord tumors. Although some writers advocated unilateral HL for intradural extramedullary tumors, for intramedullary tumors, they recommended total laminectomy [25,26].

Intraspinal lesions were, however, grossly removed with unilateral HL in our study. Because the thoracic spine has the smallest canal width, tumor removal with unilateral HL in the thoracic region was thought to be more difficult than in the cervical or lumbar regions, because the surgical corridor from the skin surface to the spinal canal is shallower. To observe the contralateral side of the spinal canal, it may be helpful to tilt the operating microscope or operating table.

CONCLUSION

If used correctly and with a reasonable learning curve, limited unilateral HL can offer enough access to the dural sac, allowing for safe resection of nearly all spinal intradural and extradural lesions. Because it takes less time to operate than a standard laminectomy, it is better for older or high-risk patients. Less discomfort, a shorter hospital stay, and fewer postoperative problems including cerebrospinal fluid leaking, pseudomeningocele, spinal deformity, and instability make this treatment a helpful tool in the arsenal of spinal surgeons.

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Case Report of a Patient Who Underwent Supercharge end-to-side (SETS) Transfer for Proximal Ulnar Nerve Injury Using AIN (Anterior Interosseous Nerve) Motor Branch

Proksimal Ulnar Sinir Yaralanmasına AİN (Anterior Interosseous Nerve) Motor Dalı Kullanılarak Supercharge end-to-side (SETS) Transferi Yapılan Hastaya Ait Vaka Sunumu

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ABSTRACT

If proximal ulnar nerve injuries are not intervened, it usually leads to irreversible and negative consequences. It results in motor and sensory defects in the areas innervated by the ulnar nerve and weakness in the intrinsic muscles of the hand. In patients with irreversible ulnar nerve damage due to cubital tunnel syndrome that have been left untreated for a long time, or proximal ulnar nerve injuries due to other reasons, the SETS method can restore especially the intrinsic functions of the hand.

In this article, a patient with ulnar nerve damage that developed after benign tumor resection in the vicinity of the ulnar nerve, and the SETS operation and its results, which was performed for a patient whose ulnar functions did not return despite being followed with EMG for 1.5 years, are presented.

Keywords: Ulnar supercharge, ulnar nerve, proksimal ulnar nerve injury, nerve transfer, end-to-side supercharge

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ÖZ

Proksimal ulnar sinir yaralanmalarına müdahale edilmezse genellikle geri dönüşsüz ve olumsuz sonuçlara yol açar. Hastalarda ulnar sinirin innerve ettiği alanlarda motor ve duyu kusuru, elin intrinsik kaslarında güçsüzlükle sonuçlanır. Uzun süre tedavisiz kalmış kübital tünel sendromuna bağlı geri dönüşsüz ulnar sinir hasarı olan hastalarda ya da diğer sebeplere bağlı gelişen proksimal ulnar sinir yaralanmalarında SETS yöntemi ile özellikle elin intrinsik fonksiyonlarında geri dönüş sağlanabilir.

Bu makalede ulnar sinir komşuluğunda benign tümör rezeksiyonu sonrası gelişen ulnar sinir hasarı olan ve 1.5 yıl EMG ile takip edilmesine rağmen ulnar fonksiyonlarında dönüş olmayan hastaya yapılan SETS operasyonu ve sonuçları sunulmuştur.

Anahtar Kelimeler: Ulnar süperşarj, ulnar sinir, proksimal ulnar sinir hasarı, sinir transferi, uç-yan sinir transferi

CASE

A 44-year-old right-handed, 85kg, 181cm male patient previously presented with a mass in the distal right humerus. After the resection of a benign calcified mass in the vicinity of the ulnar nerve, hypoesthesia was detected in the area innervated by the ulnar nerve. Control and follow-up continued with EMG. We were consulted at the 6th month control.

His complaints of numbness, tingling and loss of strength in his right hand continued. On examination, there was claw hand deformity in the 4th and 5th fingers of the right hand. There was no abduction-adduction of the fingers and atrophy of the interosseous and hypotenar muscles innervated by the ulnar nerve. Wartenberg, Jeanne and Froment sign findings were positive. Two point separation measurements were increased in the ulnar region, especially on the 5th finger (> 4mm). In the current EMG, ulnar motor conduction block was observed in the elbow segment.

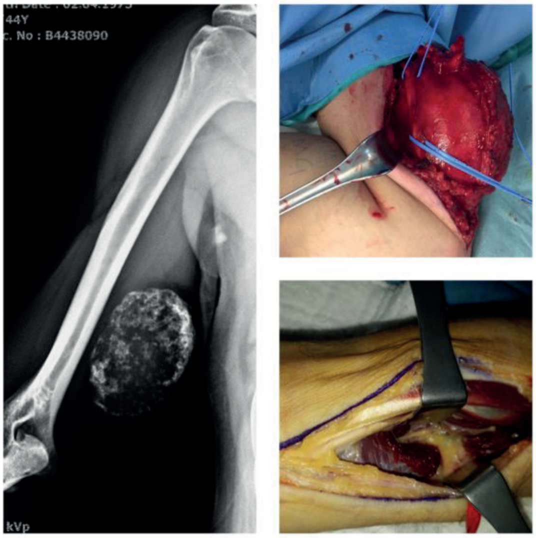

Figure 1. Benign tumor removed from the arm is seen on the left and upper right, while AIN nerve transfer to the ulnar nerve is seen in the lower right.

After talking to the patient, ulnar nerve exploration and release operation was recommended. When the ulnar nerve was explored, it was observed that its integrity was preserved. The ulnar nerve was decompressed by dissection and freed. Post-operative controls continued. Upon the persistence of ulnar neuropathy findings in the 3rd month after exploration, the patient was consulted and a decision was made for re-operation. The AIN motor branch to the pronotor quadratus muscle was separated and the distal end of the ulnar nerve was anastomosed. During the repair, the nerves were sutured as an end-to-side anastomosis. No nerve graft or neural tube was used. Splint was applied for 1 month postoperatively. Some important points about the operation;

- The nerve should not be tense.
- If electrophysiological examination is to be done during the case, tourniquet and muscle relaxant should not be used.
- If a nerve graft is to be taken, it should always be kept moist.

At the 6th month postoperative, parmar adduction functions were fully restored. In addition, the atrophic hypotenar area was almost completely filled and the atrophy signs were almost completely disappeared. In the postoperative EMG, intrinsic motor functions were normal at the distal level of the wrist.

DISCUISON

With the supercharged end-to-side anterior interosseous nerve to ulnar motor nerve transfer (SETS) method, recovery in intrinsic muscle strength and improvement in claw hand deformity can be achieved in isolated proximal ulnar nerve injuries, especially in patients with motor function loss. Barbour et al. [6] were the first to describe SETS of AIN to ulnar motor fascicles transfer. Nerve transfer has gained importance recently due to the inadequate results of direct nerve repair. The motor branch of AIN can be dissected at the entrance to the pronator quadratus muscle. Anastomosis can be performed by opening an epineural window in the ulnar nerve 6-8 cm proximal to the wrist crease.

In the study conducted by Üstün ME et al. On 10 cadaver arms in 2001, it was revealed that the most suitable nerve for motor branch transfer in patients with ulnar nerve injury is the AIN motor branch to the Pronotor Quadratus. The use of flexor pollicis longus and flexor digitorum profundus motor branches has been reported to be less suitable, as a longer segment will require grafting due to a longer distance [5].

In 2019, Eslam Koriem et al. compared isolated ulnar repair and ulnar repair + SETS method on 21 patients with ulnar nerve injury. 11 patients had ulnar repair + SETS, while 10 patients had isolated ulnar repair. The results in terms of return of intrinsic functions and regression of deformity were observed better in the UR + SETS group [1].

In 2015, Davidge KM et al. 55 patients with severe ulnar neuropathy were followed up for an average of 8 ± 5.7 months postoperatively. Satisfactory improvement in intrinsic functions was reported in 71% (39/55) of the patients [7]. In 2018, Jarvie G et al. Follow-up results of two patients who operated with SETS method were published. They reported that the intrinsic muscle strength was measured as 5/5 in the second-year control in the first patient, and 4 + / 5 in the second-year control in the second patient [3].

CONCLUSION

The supercharge end-to-side transfer (SETS) method is a successful method for restoring hypotenar atrophy and restoring the intrinsic functions of a patient with proximal ulnar nerve injury. In the case we presented, we provided a demonstrative improvement in the patient. The atrophic hypotenar area was filled and palmar adduction started again. An important point that should not be forgotten in these cases is that only motor functions will return and the sensory defect will not return because the motor branch transfer is performed.

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Case Report / *Olgu Sunumu*

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A Mass in the Neck. Lymphadenopathy or Schwannoma?

Boyunda bir Kitle. Lenfadenopati mi ya da Schwannoma mı?

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ABSTRACT

In clinical practice, it may be difficult to differentiate brachial plexus schwannoma from pathological lymph nodes. Schwannoma is a relatively rare neoplasm arising from Schwann cells of the peripheral nerve sheath. Although it can occur in any organ, including the extremities, trunk, and head, it rarely presents as an axillary or supraclavicular lesion. In this the article, a 59-year-old male patient with painless swelling in the right supraclavicular fossa and cystic lymphadenopathy reported on USG is presented.

Keywords: Brachial plexus, schwannomas, neck

ÖZ

Klinik pratikte brakiyal pleksus schwannomunu patolojik lenf nodlarından ayırt etmek zor olabilir. Schwannoma, periferik sinir kılıfının Schwann hücrelerinden kaynaklanan nispeten nadir bir neoplazmdır. Ekstremiteler, gövde ve kafa dahil olmak üzere herhangi bir organda ortaya çıkabilmesine rağmen nadiren aksiller veya supraklaviküler lezyon olarak ortaya çıkar. Bu yazıda sağ supraklaviküler fossada ağrısız şişlik ve USG'de bildirilen kistik lenfadenopatisi olan 59 yaşında erkek hasta sunulmaktadır.

Anahtar Kelimeler: Brakial pleksus, schwannom, boyun

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INTRODUCTION

Brachial plexus tumors are uncommon, comprising only 5% of the upper limb tumors. Schwannomas are slow-growing, benign tumors arising from the nerve sheath with neuroectodermal origin. Twenty-five to forty percent of these tumors are seen at the head and neck. The most common originated from the superior vestibüler branch of the eighth cranial nerve [1]. Schwannomas originating from brachial plexus are rare and presenting as a cystic mass have rarely been reported [2]. We report a schwannoma of brachial plexus mimicking cystic lymphadenopathy.

CASE REPORT

A 59 years old man was admitted to our hospital with painless swelling in the right cervical region. With the diagnosis of malignant lymphadenopathy, he was referred to an otolaryngology clinic for an excisional biopsy. On physical examination, a 3x2 cm mobile painless mass was noted in the right supraclavicular region. There was no sign of any neurological disturbance An ultrasonographic examination(USG) showed a diameter of 29x17 mm supraclavicular subcutaneous cystic lymphadenopathy (Figure 1). A chest (computed tomography) CT scan was normal. A percutaneous fine-needle biopsy of the mass revealed only cystic contain. Surgical exploration was performed under sedation with local anesthesia.

During exploration, it was seen the mass arose from the inferolateral part of the superior truncus. The mass was completely excised from the superior truncus of the brachial plexus with microdissection (Figure 2). Macroscopically, the tumor is 3.5x2x2cm in size, encapsulated, the cross-sectional face is myxoid, brown, orange-colored moire.

In microscopic examination: Tumor cells are spindle-shaped elongated nuclei. It contains cellular Antony A and myxoid Antony B areas. The cellular areas form fascicular and swirly configurations and are characteristic of the tumor (Figure 3. a-b). Verocay bodies consisting of eosinophilic cell bodies surrounded by rows of nuclei can be seen. In the S-100 immunohistochemical staining, the cells were stained diffusely (+) (Figure 3. c).On pathologic examination, it was diagnosed as schwannoma originating from the brachial plexus.

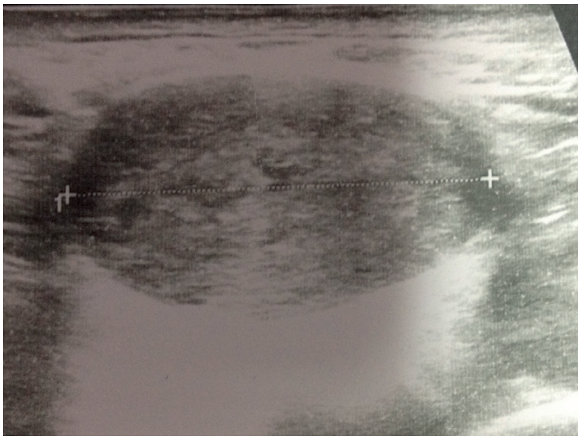

Figure 1. Ultrasound(USG) of a reported cystic mass similar to supraclavicular subcutaneous lymphadenopathy.

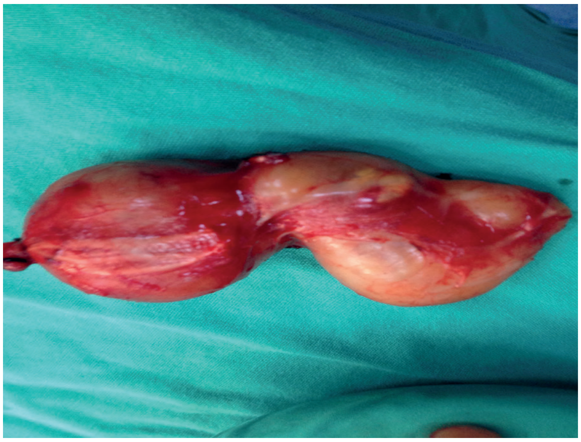

Figure 2. A mass completely removed by microdissection from the superior trunk of the brachial plexus.

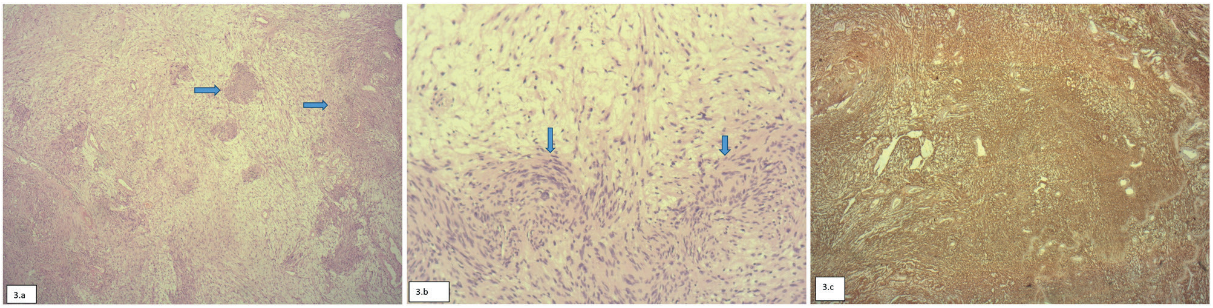

Figure 3. In microscopic examination ;a. More cellular Antony A areas (at the tips of the arrows) and hypocellular loose Antony B areas are observed. H&E X25 b. Antony A fields (at the end of the arrows) and Antony B fields. H&E X100 c. Immunohistochemically diffuse S100 positivity X25.

After the operation, the patient complained of minor sensory and motor discomfort in the right upper extremity. He had right shoulder abduction difficulty. The patient received physical therapy for three months. In the two-year follow-up, neurological findings improved. Written informed consent for publication was obtained from the patient.

DISCUSSION

Schwannoma of the brachial plexus is very rare. Most neurosurgeons encounter only a few cases during life. Generally, schwannoma of the brachial plexus presents with palpable mass such as in our case. Even though asymptomatic ten percent of schwannomas are to be malignant [2].

Knowledge of the anatomical location of the brachial plexus can be helpful for diagnostic and therapeutic purposes of various pathologic conditions in the neck. The brachial plexus is formed from the ventral nerve roots of C5 to T1. The roots increase in size from C5 to C7 then decrease from C8 to T1. These ventral roots unite to form the trunks. C5 and C6 give rise to the upper trunk, C7 to the middle trunk, and C8 and T1 to the lower trunk. They are easily detected on USG as thin, cord-like, hypoechoic structures between the anterior and middle scalene muscles [3].

USG, CT, and magnetic resonance imaging (MRI) can be used for diagnosis (1). CT and MRI are efficient that showed cystic degeneration [4]. Electromyography (EMG) examination was able to show any neural damage but % 90 of schwannomas were observed normally [5]. Percutaneous fine needle biopsy has been suggested for the management of cervical mass. However, in cervical masses, thought to be a neurogenic tumors, a fine needle biopsy is only recommended for suspected malignancy, and better surgical treatment results are observed in those who do not undergo biopsy [5].

The first option in the treatment of schwannoma is surgical resection. However, the resection limits of the tumor are always difficult and controversial. Neurological disorders may occur during differentiation from the nerve sheath [6]. Post-operative motor and sensitive deficits occurred in our case as well. Anti-edema treatment was applied for the first week and then rehabilitation with physical therapy.

In conclusion, brachial plexus schwannoma is a rare phenomenon. It can mimic cystic lymphadenopathy. It should be considered in the differential diagnosis of supraclavicular masses.

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Nöroendoskopi – Ekipmanlar, Kullanım ve Çalışma İlkeleri

Neuroendoscopy – Equipment, Use and Operating Principles

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ÖZ

“Endoskop”; içeri, içeriye anlamına gelen “endo” ve görmek, görüntülemek anlamına gelen “skope” kelimelerinin birleşmesi ile oluşan Yunanca kökenli bir kelimedir. Nöroşirurji alanında endoskop ilk olarak ventrikül içi patolojilerin ve hidrosefalinin tedavisinde kullanılmıştır. Başarısız cerrahi girişimler nedeniyle gündemden düşen nöroendoskop ilerleyen zamanlarda mikrocerrahiye yardımcı olması amacıyla yeniden kullanıma girmiştir.

Anahtar Kelimeler: Nöroendoskopi, ekipmanlar, çalışma prensipleri

ABSTRACT

“Endoscope”; It is a word of Greek origin, formed by the combination of the words “endo” meaning inside, inside and “skope” meaning seeing and viewing. In the field of neurosurgery, the endoscope was first used in the treatment of intraventricular pathologies and hydrocephalus. The neuroendoscope, which fell off the agenda due to unsuccessful surgical interventions, was later reintroduced to assist microsurgery.

Keywords: Neuroendoscopy, equipment, operating principles

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GİRİŞ

İki yüz yıllık tasarım sürecinden sonra endoskopi nöroşirurjikal girişimlerde intraventriküler cerrahi, kafa tabanı cerrahisi, spinal cerrahi ve diğer çeşitli uygulamalar amacıyla günümüzde yaygın olarak kullanılmaktadır.

1900'lü yılların başında başarısız cerrahi girişimler nedeniyle gündemden düşen nöroendoskop, ilerleyen zamanlarda mikrocerrahiye yardımcı olması amacıyla yeniden kullanıma girmiştir. Teknolojinin gelişmesiye etkinliği artan nöroendoskopi tamamlayıcı özelliğinden ziyade başlı başına nöroşirurji ameliyathanesinin vazgeçilmez bir ekipmanı haline gelmiştir.

Günümüzde kullanılan nöroendoskopun temel fiziksel özelliklerini ve hassas ekipmanlarını anlamak, başarılı ve güvenli bir cerrahi için kaçınılmazdır. Bu yazıda amacımız güncel nöroşirurjikal alanda kullanılan nöroendoskopinin hekimlere; çalışma ilkelerinin, kullanımı ile ilgili temel bilgilerin ve ekipmanlarının açıklanmasıdır.

NÖROENDOSKOPİNİN PARÇALARI

a-Optik Komponentler

Fiberoptik Skoplar

Fiberoptik skoplar, prizma iç duvarlarından ışığın yansıması prensibi ile çalışan bükülebilir silika-cam liflerinden oluşur. Her silika-cam lifi kırıcılık indeksine kıyasla çok düşük olan bir kaplama materyali kullanılır (kırıcılık indeks oranı yaklaşık 1,65). Bu şekilde iki fiberoptik lif arasında ışık geçişini engellenir [6].

Fiberoptik desteler iki ayrı dizilişte planlanır. Koherent diziliş distal uçtan proksimal uca görüntünün gözlemciye ulaşmasını sağlar. İnkoherent diziliş ise ışık kaynağından çıkan ışığı cerrahi sahaya taşır. Fiberoptik skoplar, 2500 ile 30000 koherent fiberden oluşabilir fakat çoğu modern fiberoptik skop 6000 ile 10000 arasında koherent fiber içerir [4].

Optik fiber sayısı ve fiberoptik skopun çapı görüntü kalitesi ile doğrudan ilişkilidir. Yüksek kalite 1mm çaplı fiberoptik skop 10000 piksel içerir. Yüksek görüntü kalitesi elde etmek için görüntünün ekranda pikseller arasında boşluk oluşturmayacak kadar büyütülmesi gerekmektedir. 10000 piksel fiberskopta en fazla 20 cm'e (8 inç) kadar görüntü büyütülebilir. Günümüz şartlarında fiberskop ile daha iyi görüntü kalitesi mümkün değildir [6]. Her kullanımdan önce fiberskopun görüntü kalitesi kontrol edilmelidir. Optik fiberler travmaya karşı çok hassas olduğundan operasyon sırasında kolayca kırılabilir ve kırılan optik fiberler monitörde siyah nokta olarak görüntü verir. Ayrıca video sistemi ve lens arasında yer alan "coupler" görüntü kalitesi açısından fiberskoplarda önemli yere sahiptir [6]. 1960'lı yıllardan önce tıpkı eski tip mikroskoplarda olduğu gibi endoskoplarda da ışık kaynağı olarak sıcak ışık yayan küçük tungsten ampuller kullanılmaktaydı. Bu durum ameliyat esnasında iki tür dezavantaj ortaya çıkarmaktaydı. Birincisi, ışık kaynağından yayılan ısı cerrahi sahadaki dokulara zarar vermekteydi. İkinci olarak da tungsten ampuller mavi ışık dalgası yayımlamadığı için çalışılan sahayı kırmızı renk ağırlıklı bir görüntü ile ortaya koymaktaydı [9].

1956 yılında Gastroentorolog olan Dr. Basil Hirschowitz'in ilk fiberoptik endoskopu kullanmasıyla endoskopi alanında yeni ufuk açıldı. Fiberoptik endoskopun kullanıma girmesiyle hem daha doğal bir ışık kaynağı ile çalışma imkanı doğdu hem de ısı nedeniyle ortaya çıkan doku yaralanmasının önüne geçildi.

Bir optik lif; silika (cam) yada plastikten yapılan, bükülebilir, saydam, insan saç telinden de ince bir materyaldir. Fiberoptik sistem, koherent ve inkoherent yolaktan oluşmaktadır. Koherent yolak cerrahi sırasında görüntüleme, inkoherent yolak ise cerrahi sahayı aydınlatma görevini yapmaktadır [9]. Fiberoptik endoskoplarda çözünürlük piksel olarak ölçülmektedir. Koherent lif sayısı arttıkça piksel sayısı ve dolayısıyla çözünürlük de arttırmaktadır. Çoğu fiberoptik endoskop 2.500 ile 30.000 piksel içermektedir. Endoskopun çapı piksel sayısına doğrudan etki etmektedir. Çap arttıkça piksel sayısında artış olası hale gelmektedir. Bu da, diğer taraftan, ekipman giderlerini arttırmaktadır. İyi kalite 1 mm çapında bir nöroendoskop 10.000 piksel içerir ve yüksek çözünürlüklü görüntü sağlar. 1 mm'den 3 mm'ye kadar olan daha büyük endoskoplar 30.000 piksele kadar çözünürlük imkânı sunar [6]. Fakat fiberoptik endoskopların kullanımı esnasında yapılan manevralar nedeniyle optik liflerin kırılması piksel kaybına neden olur ve böylece zamanla görüntü kalitesi bozulur.

Rijid-lens Skoplar

İlk kullanılan skoplar geniş hava boşluklarını sınırlayan ince cam lensler içeriyordu. Kırıcılık indeksi ile endoskoptan taşınan ışık miktarının doğru orantılı olduğunu ve bunun için daha çok cam materyal kullanılmasının gerektiğini fark eden Hopkins, geniş hava boşlukları yerine cam lens, ince cam lensler yerine hava kullanarak "rijid-lens skop"ları geliştirdi [9]. Hopkins'in geliştirdiği lens sistemi Nitze'nin aynı çaplı eski dizaynı ile karşılaştırıldığında Hopkins lens sistemi ışığı yaklaşık 9 kat daha iyi iletir. Hopkins, bu durumu ışık iletiminin (L), 4R (R: kırıcılık indeksi) ile orantılı olmasıyla açıklamıştır [6].

Işık iletiminde bir başka önemli konu ise "kaplama"dır. Cam lens içinden geçen ışık, her kırılma anında %5 azalır. Rod-lens sisteminde birden fazla cam materyal olduğunu düşünürsek rod-lens sistemi için bu kayıp önem kazanır. Bunun önüne geçmek için bütün cam yüzeyler ultraince magnezyumflorid katman ile kaplanır. Bu katman kırılma anında ışık kaybını azaltır ve hem endoskop hem de kamera için optik kaliteyi arttırır [4,5,8].

Rigid-lens skopların çözünürlüğü fiberoptik skoplarda olduğu gibi piksel ile sınırlı değildir. Rigid-lens skoplar, fiberoptik skoplara göre daha iyi çözünürlük ve odaklanma kalitesi sağlar fakat rigid-lens skopların yarıçapının daha geniş olması zorunluluğu bir dezavantajdır [6]. Lens ve video sistemi arasındaki "coupler" fiberoptik skoplarda olduğunun tersine çözünürlüğe etkisi düşüktür. Fiberoptik skoplara nazaran rijid-lens skoplar daha düşük ışıkta aynı görüntü kalitesi elde edilebilir [6]. Bunun yanı sıra rigid-lens skoplar, distal lensinin açısına göre 00den 1200ye kadar görüş açısı sağlar [1].

1960'lı yıllara kadar kullanılan konvensiyonel cam-lens endoskoplardaki lens sistemindeki optik zincir daha küçük lensler ve daha büyük hava boşlukları ile oluşturulmaktaydı. Endoskopta ışık iletiminin kırıcılık indeksi ile doğru orantılı olduğunu fark eden Harold H. Hopkins, uzun cam-lensler ve küçük lens benzeri hava boşlukları ve nötral camlardan oluşan yeni bir lens sistemi geliştirmiştir [9].

Fiberoptik endoskoplarla karşılaştırıldığında rod-lens sistemi, ışığı doğrudan aktardığı için daha iyi ışık iletimi, daha iyi çözünürlük, daha gerçek renk ayrımı; içerdiği uzun cam-lensler ve küçük hava boşlukları sayesinde ise daha geniş görüş açısı ve daha fazla büyütme oranı sağlamaktadır [6]. Rod-lens endoskoplar rijid olarak kullanılmaktadır. Rijid endoskoplarda kullanılan skoplar 0º, 30º, 70º ve 120ºliktir. Sıklıkla kullanılan skoplar ise 0º ve 30ºlik skoplardır. 0ºli skoplarda doğrudan karşıyı gördüğümüz için cerrahi olarak el-göz oryantasyonu daha iyi sağlanmaktadır. Skop açısının artmasıyla ile görüş açısının değişmesi ve görüş alanının artması, cerrahi alana ulaşılabilirlik açısından daha geniş imkânlar sağlarken cerrahın el-göz oryantasyonunu giderek bozmaktadır. Fakat bu alanda tecrübe kazandıkça cerrahın manüplasyon yeteneği artmaktadır [6,9].

Işık Kaynağı

İnsan gözü, güneş ışığına adaptedir ve dünya atmosferi içinde deniz seviyesinde hissedilen ışığa "iyi ışık" denir. Güneş, gün içerisinde tepe noktasındayken ışık sıcaklığı yaklaşık 6000 K olarak kabul edilir. (Light and light sources Peter G. Sf 17-18) Endoskopta kullanılan ışık kaynağı hem operatöre "iyi ışık" altında çalışma imkanı sağlamalıdır hem de ışığı sağlarken oluşturduğu ısı, cerrahi sahadaki dokuya zarar vermemelidir. 1963 yılında ilk kez Storz tarafından üretilen ve isimlendirilen soğuk ışık kaynağı, diğer ışık kaynaklarına göre ısı yayılımı daha düşüktür. Isı yalıtımına rağmen yüksek ışık enerjisi nedeniyle endoskopun uç kısmı yine de dokulara zarar verebilir [2,7].

Son yıllarda soğuk ışık kaynağı olarak, ışık sıcaklığı 5600-6400 K arası olan Xenon lambalar kullanılmaya başlanmıştır [3]. 300W ile 500W arasında olan bu ışık kaynağı üstün resim kalitesini sağlamaktadır [9]. Uygun ışık kaynağına rağmen, ışık kaynağındaki ve optik sistem içerisinde ışık iletimi sırasında kayıplar günümüzde hala çözüm bekleyen bir problemdir. Özellikle fiberoptik skoplarda inkoherent ve koherent demetler arasında uygunsuz geçişler, kullanılan kaplama materyalinin ışığı absorbe etmesi ve daha geniş olan ışık kaynağı kabloları ile daha ince olan nöroendoskop arasındaki bağlantı yolları arasında olan kayıplar nedeniyle ışık kaynağından sağlanan ışığın değeri %30'a kadar azalabilmektedir [4,9].

1-Işık Kaynağı

Endoskopik cerrahi operasyonlarda 60'lı yılların ortalarına kadar sıcak ışık kaynağı kullanılmaktaydı. Enerjinin %90'ını ısıya, sadece %10'u ışığa dönüşmekteydi. Dolayısı ile bu sistem istenmeyen yanık ve sonuçta nekrozlara neden oluyordu. 1962'de Karl Storz ışığı ileterek görüntü elde etmek amacıyla cam fiberlerin kullanılabildiğini keşfetti. Artık günümüzde rod lens optik sistemleri ve fiberoptik eksternal soğuk ışık iletimi Storz'un lisanslı fikri olarak endoskop aydınlatma sistemlerinde standart olarak kullanılmaktadır (Resim 1).

Resim 1. Soğuk ışık kaynağı "*LP 5124 XENON 180W*" (Richard Wolf, Knittlingen, Almanya)

Kamera

Kamera, endoskopi sisteminin en önemli parçası olarak düşünülebilir. Uygun kamera seçiminin video zinciri ve aksesuarları, endoskop tipi ve yayın ekipmanları seçildikten sonra yapılması daha faydalıdır [6].

Günümüzde daha yaygın olarak kullanılan kamera tipi, "chip" kamera ya da "charged-couple device" kameradır. "Single-chip" ve "three-chip" olarak iki tipi mevcuttur. (Constantini) CCD kameranın çalışma prensibi, mikroişlemci teknolojisi ile aynıdır. CCD üzerinde horizontal ve vertikal olarak yerleştirilmiş pikseller bulunmaktadır. Pikselin üzerine ışık düştüğünde ışığın şiddetine göre elektrik akımı oluşur. Her pikselin oluşturduğu farklı voltajdaki elektrik akımları bir matriks gerilim olarak okunur ve bu matriks gerilim analog-dijital çevirici (ADC) ve işlemci ile senkronize edilir ve dijital resim olarak depolanır [6,9]. CCD kameraların kullanıma başlanması nöroendoskopi için bir dönüm noktası olmasına rağmen SD (standart definition) three-chip CCD kameraların sağladığı görüntü kalitesi dahi arzu edilen ideal görüntü kalitesine yaklaşmamıştır. Son yıllarda kullanıma giren HD (high definition) three-chip CCD kameralar; hem SD three-chip CCD kameralara göre 5 kat daha yüksek çözünürlük (HD 1920x1080=2.073.600, SD 720x576=414.720), hem de 16:9 görüntü genişliği ile SD kameraların sağladığı 4:3 ekran genişliğine göre daha geniş görüş alanı sağlamakta. Ayrıca SD three-chip CCD kameranın sağladığı resim hızı 25 fps (frame per second) iken HD three-chip CCD kamerada resim hızı 50 fps'dir. Bu nedenle görüntü netliği açısından da HD three-chip CCD kameraların SD three-chip CCD kameralara göre tartışmasız üstünlüğü vardır. Bununla birlikte HD kameraların SD kameralara göre daha ağır olması cerrah açısından bir dezavantaj olarak kabul edilebilir.

Son zamanlarda CCD teknolojisine göre daha düşük güç tüketimi sağlayan ve geleneksel yöntemlerle üretildiği için daha düşük maliyetli olan CMOS (Coplementary Metal Oxide Semiconductor) kameralar kullanılmaya başlanmıştır. CMOS kamera teknolojisinde piksel yerine her birine ayrı olarak bağlı kablolarla iletimi sağlanan transistörlerle görüntü oluşumu sağlanmaktadır. Aynı görüntü kalitesini yakalamak için CMOS kameraların CCD kameralara göre daha parlak ışığa ihtiyacı vardır. (A CMOS in-pixel Murari) Ancak CMOS kamera teknolojisinin CCD kamera teknolojisine göre daha başarısız olduğu sonucuna varılmamalıdır. Günümüzde hem CMOS hem de CCD teknolojisinde yüksek performans sağlanmaktadır ve CMOS kamera teknolojisi CCD kamera teknolojisinin aksine büyük ölçüde gelişimini tamamlamamıştır.

2-Kamera, Kamera Kontrol Birimi - Ekran ve Görüntü Kaydedici

Artık günümüzde kamera sensörü CCD (Charge Coupled Device) tiptedir. Renklerin daha iyi rezolusyonunu ve parlak olmasını sağlar. Üç adet optik prizmaya sahip olan bu kamera, görüntünün keskinliğini arttırarak kontrast ayarının daha iyi olmasına olanak sağlar. Video kameralar çoğunlukla analogdur ve optik zoom vardır. Analog kameradan CPU'e (Central processing unıt) ulaşan sinyal buradan değişik kayıt cihazlarına sinyaller gönderebilir (Resim 2).

Genellikle endoskopik kamera üzerinde zoom, netlik ve beyaz ayarı için olanların dışında çok fazla buton yoktur. Fakat monitör ve video kayıt cihazı üzerinde renk, parlaklık, kontrast vb. ayarları sağlayan butonlar bulunmaktadır ve bunların ameliyatı yapacak olan cerrahi ekip ve personel tarafından iyi bilinmesi gerekmektedir (Resim 2).

Resim 2. Kamera ve kamera kontrol ünitesi

Analog sinyal işleme sistemli, üç "CCD" çipli, görüntüyü, netliğini bozmadan 21-36 mm mesafede optikal olarak büyütebilme özelliğinde olan ve PAL görüntü sistemini kullanan, "*MEDICAL HD ENDOCAM 5509 PAL*" Richard Wolf (Knittlingen, Almanya).

Monitörün büyüklüğü ise cerrahın işlemi yaptığı mesafeye bağlıdır. 1,5m.' ye kadar olan kısa mesafelerde 36 cm'lik küçük, 1,5m.'den daha uzak mesafelerde ise 50 cm ve üzeri boyutta monitörler kullanılması önerilmektedir (Resim 3).

Resim 3. Flat Screen Monitor

Çözünürlüğü 1280x1024 ve kontrast oranı yukarı/aşağı/sol/sağ >10:1 89°/89°/89°/89° olan 19 inch "LMD-1950MD Sony" (Japonya).

Monitör

Monitör seçiminde çözünürlük, ekran büyüklüğü ve maliyet göz önünde bulundurulması gereken üç önemli unsurdur. Görüntü kalitesi açısından yüksek çözünürlüklü monitör daha iyi görüntü kalitesi sağlar. Bu nedenle kullanılan kamerayla karşılaştırıldığında daha düşük çözünürlükte monitör kullanmak, kameranın cerraha sağlayacağı avantajları yok etmektedir. Aynı zamanda kullanılan kameranın çözünürlük kalitesinden daha yüksek çözünürlük kalitesinde monitör kullanmak da gereksizdir. Çünkü daha iyi bir monitör, kameradan aldığı görüntü kalitesini arttırmayacaktır [9].

Monitör seçiminde daha büyük ekran seçmek her zaman daha iyi görüntü elde edilmesi anlamına gelmeyebilir. Özellikle piksel teknolojisi ile çalışan fiberskop kullanımında ekran büyüklüğü, fiberskopun sağlayacağı en geniş görüntü boyutundan daha büyük olursa ekranda izlenen pikseller arası mesafe artacağı için görüntü kalitesi düşecektir [6]. Monitörün ekran büyüklüğü seçiminde bir başka önemli unsur ise cerrahın işlemi yaptığı mesafedir. 1,5 metreye kadar olan kısa çalışma mesafesinde 36 santimetre boyutunda; 1,5 metreden daha uzak çalışma mesafelerinde ise 50 cm ve üzeri boyutlarda monitörler kullanılması önerilmektedir.

2000'li yıllardan önce CRT (catode ray tube) monitörler kullanılırken özellikle son 10 yıllık süreçte DTV (digital television) monitörler daha yaygın olarak kullanılmaya başlanmıştır. DTV monitörlerin çalışma prensibi, gelen dijital sinyallerin dekoder aracılığıyla çözümlenerek dijital görüntüye çevrilmesi esasına dayanır. HDTV (High-resolution digital television) monitörler, 1080x720 ya da 1920x1080 çözünürlük özelliği ile DTV monitörlere göre daha üstün görüntü kalitesi sağlar. HDTV iki farklı formatta çalışır: "interlaced" (i) ve "progressive" (p). "Interlaced" formatında ekran horizontal hatlar halinde iki ayrı parçaya bölünür. Bir parçada tek sayı ile numaralandırılmış resim yayınlanırken diğer parçada çift sayı ile numaralandırılmış bir sonraki resim yayınlanır. Geleneksel CRT televizyonlarda kullanılan bu teknoloji, daha küçük ekranlı dijital TVlerde görüntü farkı yaratmasa da, daha büyük ekranlı dijital TVlerde görüntüde titreme hissi oluşmasına neden olur. "Progressive" formatında ise ekranda tek seferde tek resim yayınlanır ve tüm resimler ardışık olarak sırasıyla ekrana gelir. Bu durum, daha fazla bant genişliği ihtiyacı doğurması ile beraber daha yumuşak resim geçişi sağlar.

Video ve Kayıt

Fiberoptik endoskoplarda, kaliteli video görüntüsü elde etmek için kamera ve aktarım cihazlarının çözünürlüğü yüksek olmadı ve büyütme oranı iyi seçilmelidir [6]. Geçmişte video kayıt cihazları kullanılırken artık günümüzde bu görevi monitör veya aktarım cihazlarının içinde bulunan hard diskler üstlenmiştir.

b-Nonoptik komponentler

İrrigasyon Pompası

1-Cerrahi irigasyon pompası

1,5 lt/dk akış hızı ve 150 mmHg basınç kapasiteye sahip, sıvı yönetim sistemi özelliği ile kullanılan sıvının miktarını da otomatik olarak hesaplayabilen cerrahi irigasyon pompası (Resim 4).

Resim 4. Cerrahi irigasyon pompası

"*2203 FLUID CONTROL SYSTEM*" (Richard Wolf, Knittlingen, Almanya).

Bipolar Koagülatör

1-Radiofrekans cihazı

Perkutan tam endoskopik spinal cerrahi için özel olarak geliştirilmiş, 4,0 Mhz frekans kapasitesinde ve yüksek frekans kapasitesine sahip olduğundan düşük güçte bile sinir dokuları üzerinde güvenli bir koagülasyon olanağı sağlayan, monopolar ve bipolar özelliğe sahip radyofrekans cihazı (Resim 5).

Resim 5 Radyofrekans cihazı

"*2343Surgitron 4,0 Mhz Dual*" Richard Wolf Corporation (Ellman, NY, Amerika Birleşik Devletleri)

- Cerrahi Enstrümanlar

a- Cerrahi El Aletleri

Kranial ve spinal cerrahi için geliştirilmiş el aletleri mevcuttur. Resim 6 da spinal cerrahi için gerekli el aletleri demostratif olarak verilmiştir.

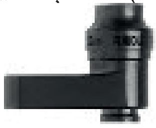
a. Spinal iğne (1,25 mm genişlikte, 25 cm uzunlukta)

b. Disektör (2,5 -4,0 mm genişlikte, 35 cm uzunlukta)

c. Dilatatör (5,9 – 6,9 mm genişlikte, 7 cm uzunlukta, çift kanallı)

d. Çalışma kanülü (30°, 8 mm genişlikte, 18,5 cm uzunlukta)

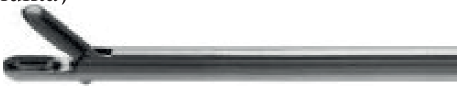
e. Çalışma kanünü ataşmanı (8 mm genişlik için)



f. Mikro-rongeur (2,5 mm genişlikte, 29 cm uzunlukta)

g. Mikro-punch (2,5 mm genişlikte, 29 cm uzunlukta)

h. Mikro-rongeur (2,0 mm genişlikte, 29 cm uzunlukta)



i. Hook (2,0- 2,5 mm genişlikte, 29 cm uzunlukta)

j. 25° teleskop (4,1 mm genişlikte çalışma kanalı, 6,9 x 5,9 çaplı 16,5 – 20,7 cm uzunlukta)

k. Radyofrekans bipolar probu (2,5 mm genişlikte)

Resim 6a, b, c, d, e, f, g, h, i, j, k: Endoskopik lomber cerrahi için gerekli ekipmanlar.

SONUÇ

Teknolojik gelişmelerin etkileri Nöroşirurji pratiğine de yansımaktadır [10]. 1900'lü yılların başında başarısız cerrahi girişimler nedeniyle gündemden düşen nöroendoskop ilerleyen zamanlarda mikrocerrahiye yardımcı olması amacıyla yeniden kullanıma girmiştir. Teknolojinin gelişmesiye etkinliği artan nöroendoskopi tamamlayıcı özelliğinden ziyade başlı başına nöroşirurji ameliyathanesinin vazgeçilmez bir ekipmanı haline gelmiştir. İki yüz yıllık tasarım sürecinden sonra endoskop nöroşirurjikal girişimlerde yaygın olarak kullanılmaktadır. Günümüzde kullanılan nöroendoskopun temel fiziksel özelliklerini ve hassas ekipmanlarını anlamak, başarılı ve güvenli bir cerrahi için kaçınılmazdır.

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