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OLGU SUNUMU/CASE REPORT

Servikal Füzyon İçin Alternatif Bir Teknik: Dairesel Şekilde Yerleştirilen Kemik Grefti

An Alternative Technic For Cervical Fusion: Circularly Placed Bone Graft

Ahmet Gürhan Gürçay[1] **ORCID No: 0000-0002-8810-938X,**
Hümeyra Kullukçu Albayrak[2] **ORCID No: 0000-0003-0675-8288**

[1] Ankara Yıldırım Beyazıt Üniversitesi Tıp Fakültesi, Beyin ve Sinir Cerrahisi Kliniği, Ankara, Türkiye.
[2] Ankara Şehir Hastanesi, Beyin ve Sinir Cerrahisi Kliniği, Ankara, Türkiye.

Geliş Tarihi/Received: 26.05.2021
Kabul Tarihi/Accepted: 22.10.2021
Yazışma Adresi/Address for Correspondence:
Hümeyra Kullukçu Albayrak
Ankara Şehir Hastanesi, Üniversiteler, 1604. Cd. No: 9 D:9,
06800 Çankaya/Ankara, Türkiye.
E-mail: humeyrakullukcu@hotmail.com

Anahtar Sözcükler:
Dairesel Kemik Grefti
Plaklı Korpektomi Kafesleri
Spinal Füzyon

Key Words:
Circular Bone Greft
Plated Corpectomy Cages
Spinal Fusion

ÖZ

Spinal stabilizasyonda son derece gelişmiş spinal implantlara ve cerrahi tekniklere rağmen günümüzde halen kaynamama en önemli sorunu teşkil etmektedir. Spinal füzyonun başarısında rol alan faktörler arasında, greft materyalinin tipi, füzyon alanının greft dokusu ile mümkün olan en geniş yüzeyde teması, çevre kas ve yumuşak doku ile füzyona uğrayacak kemik dokuların uçlarının kanlanmalarının iyi olması, füzyona uğrayacak kemik dokuların hareketinin engellenmesi, füzyonu hedeflenen alana uygun greft dokusunun yerleştirilmesi sayılabilir. Bu nedenle, füzyon oluşumunun temel şartlarından biri olan geniş kemik-greft alanının oluşturulabilmesini amaçlayan alternatif bir kafes- greft yerleştirme tekniğini geliştirip kullanarak radyolojik ve klinik takipini değerlendirdik. Uyguladığımız bu yeni alternatif teknikte, plaklı servikal korpektomi kafesinin anterior ve lateral yüzlerini temas edip dairesel tarzda tamamen dolduran greft materyalinin, bu şekilde yerleştirme sonrasında radyolojik olarak dairesel tarzda kemik füzyon oluşturduğunu gözlemledik. Bu graft yerleştirme şeklinin olası instabiliteyi azaltacağını düşünmekteyiz.

ABSTRACT

Despite the highly developed spinal implants and surgical techniques in spinal stabilization, fusion failure is still the most important problem today. Among the factors that play a role in the success of spinal fusion, are type of graft material, contact of the fusion area with the graft tissue on the widest possible surface, good blood supply of the ends of the bone tissue that will fuse with the surrounding muscle and soft tissue, prevention of the movement of bone tissues that will be fused and placement of appropriate graft tissue in the targeted area for fusion. Therefore, we have developed and evaluated the radiological and clinical follow-up of an alternative cage - graft placement technique aimed at creating a large bone-graft area, which is one of the main conditions for the formation of fusion, and using it. In this new alternative technique we applied, we observed that the graft material that contacted the anterior and lateral faces of the cervical corpectomy cage with plates and completely filled them in a circular style formed a radiologically circular-style bone fusion after placement in this way. We believe that this graft placement will reduce possible instability.

Introduction

Spinal fusion is a surgical technique that enables the fusion of vertebrae by providing bony fusion between two or more vertebrae and thus prevents movement between the vertebrae, and the frequency of this intervention has increased in recent years. While instruments provide temporary support to the spine in spinal stabilization surgery, a solid fusion is required for permanent stability. Pseudoarthrosis is defined as the radiological examination of the absence of solid fusion in the fused moving segment and continuation of movement in the spinal motion segment after fusion causing symptoms and clinical findings. Failure to form fusion results in fatigue and failure of spinal supporting instruments, and consequently persistence of symptoms related to spinal instability. Currently, the fusion failure rate in spinal instrumentation is 5-35% in single-level fusions, while this rate increases to 35-40% in multi-level fusions (1).

Gürçay AG, Albayrak HK. Servikal füzyon için alternatif bir teknik: Dairesel şekilde yerleştirilen kemik grefti. Hitit Med J 2022;4(1):29-33.
DOI: 10.52827/hititmedj.943293

Although many factors play a role in the success of spinal fusion, type of graft material takes the first place. Apart from this, other conditions necessary for spinal fusion to occur in optimum conditions are good blood supply of ends of bone tissues to be fused, good blood supply of surrounding muscle and soft tissue, preventing the movement of the bone tissues to be fused, and placing the appropriate graft tissue in the targeted area. For this purpose, autografts are the best option for bone grafts used in fusion surgery today. Apart from this, other grafts used are allograft, xenograft, demineralized bone matrix (DBM) and inorganic components (hydroxyapatite, tricalcium phosphate). Radiological examinations such as direct radiography, dynamic flexion-extension graphy, 3D computed tomography (CT) with sagittal and coronal reconstruction, SPECT and SPECT-CT are used in the diagnosis and follow-up of spinal fusion.

Despite highly developed spinal implants and surgical techniques, insufficient spinal fusion is still emphasized as the most important cause of instability in cases developing pseudoarthrosis after spinal instrumentation.

Case Report

A 17-year-old male patient who received informed consent and with the compliant of severe neck pain was admitted to our clinic after falling from height. The neurological examination was normal except local pain with palpation. The X-Ray and the computed tomography (CT) scan showed C5 burst fracture involving a single endplate with involvement of the posterior vertebral wall and the T2-weighted magnetic resonance (MR) scan showed posterior capsuloligamentous complex injury without complete disruption (Figure 1). We performed anterior C5 corpectomy and fusion with plate corpectomy cage/otogreft+ calcium phosphate cement (Axoz QS) combination due to the clinical and radiological findings. After the surgery, his symptoms resolved and he was discharged on day 2. On the fourth month and fourth year radiological and clinical follow-up, spinal fusion was occurred (Figure 2, 3) and no complications were detected.

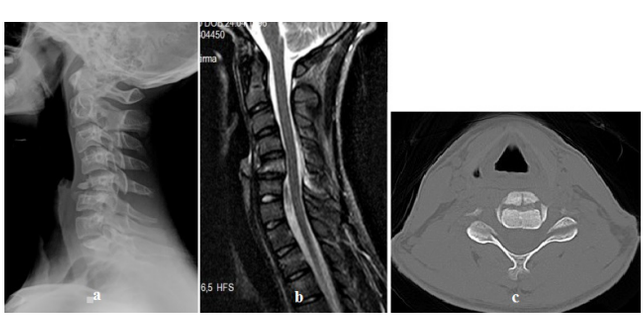

Figure 1. a) Preoperative sagittal X-Ray scan, b) Preoperative sagittal T2-weighted MRI scan and c) Preoperative sagittal CT scan.

Figure 2. a) Postoperative 1st week and b) Postop 4th year lateral X-ray scan.

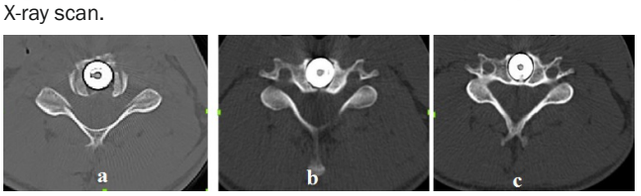

Figure 3. a) Postoperative 1st week b) Postop 4th month and c) Postop 4th year axial CT scan.

Surgical Tecnique

The patient was positioned supine on the operation table. The head was positioned neutrally with the neck in mild extension. Both arms were tracted downwards from the shoulders in order to use fluoroscopy. A transverse skin incision was made and adjusted for the level of planned corpectomy. The skin was liberated from subcutaneous tissue in order to provide adequate space following skin incision. The platysma was incised longitudinally and a subplatysmal dissection was carried out to obtain a wider surgical area. The prevertebral space was reached following the blunt dissection of the sternocleidomastoideus muscle with the carotid artery laterally and oesophagus and trachea medially. The level of corpectomy was identified using fluoroscopy and the sides of longus colli muscles attached to the vertebral corpi were incised 3-4 mm laterally using bipolar coagulation. Retractors were placed after reaching the desired level. Microdiscectomy was carried out on the upper and lower level discs of the level of corpectomy. The corpus window was created to be rectangular by cutting a 10mm from the midline to both laterals by using a 15mm long drill bit at right angles to the midline to the corpus from the upper disc space to the lower disc space. The inside of the rectangular area created was collected with the help of bone rongeur to form a graft. The posterior of the corpus was toured with a high-speed motor until the PLL was reached by using the diamond tip and the

corpectomy was completed. Then, the lower and upper end plates were rendered parallel and neighboring vertebral corpi were decorticated in order to prepare them for grafting. Since complete conformity of the graft and the vertebra corpus increases the area of fusion, complete contact of end plates with the graft and the preservation of the vertebral axis were confirmed (Figure 4).

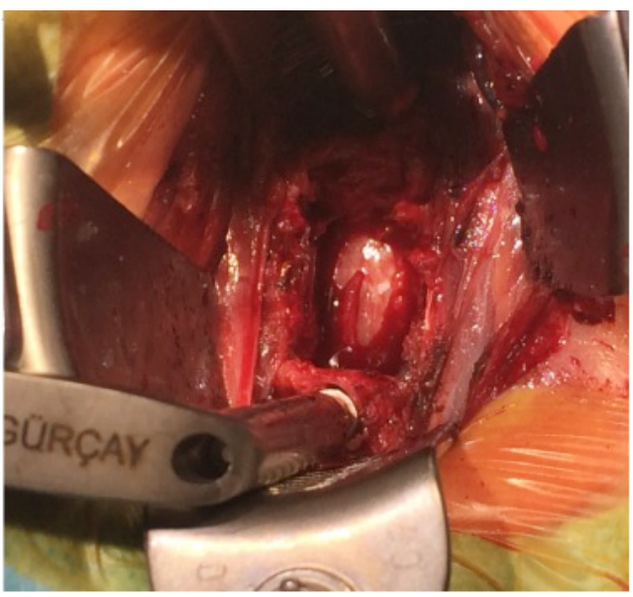

Figure 4. The appearance of the surgical field after corpectomy.

The length of the graft was measured without placing traction on the head and it was placed to the gap while traction was applied to the head accompanied by neuromonitorization. Autografts released from the patient after corpectomy were mixed with cement named Axoz QS ®, which contains calcium phosphate and has a freezing time of 100% within a maximum of 24 hours (Figure 5).

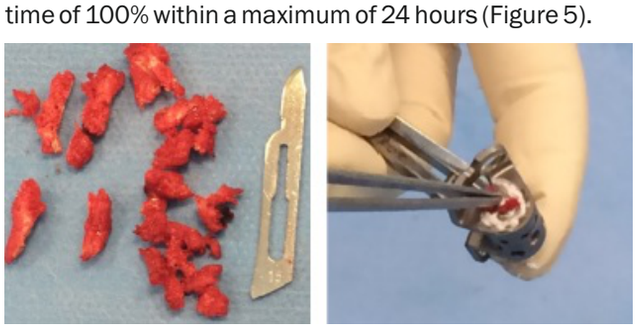

Figure 5. Placing the prepared autograft into the corpectomy cage filled with cement containing calcium phosphate (Axoz QS).

Some of the graft material obtained was placed to fill the corpectomy cage to be placed at a distance. A tight fitting contact between the graft and the neighboring vertebral corpus was achieved. During plate placement, upper screws were directed cranially and medially and the lower screws were directed caudally and medially with freehand technique while avoiding contact with the lower and upper disc space in order to avoid malposition of the screws. Length of the screws was selected after CT measurements so that they would not protrude beyond the posterior wall of the corpus. The gap between the remaining graft material and the body of the corpectomy cage and the plaque part was completely filled to leave a circular opening of about 2mm in diameter for possible hematoma drainage, and the anterior face of the corpectomy cage was completely covered with graft material. Approximately 10 minutes later, the graft material prepared by mixing with Axoz Qs was observed to harden (Figure 6). Operations were ended after checking with fluoroscopy. Selections from postoperative results have been presented with figures.

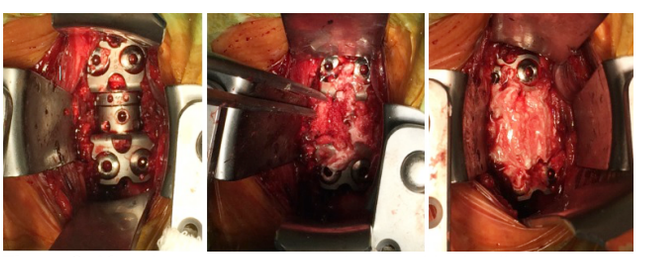

Figure 6. After the corpectomy cage is placed in the distance, the gaps between the distance and the top of it are completely covered with graft material.

Discussion

Although corpectomy cage systems with expanding plates have often taken their place in tumor reconstruction, their successful use in degenerative and traumatic cervical spine surgery has been reported in recent publications. According to the party that support the use of this cage, a segmental over-distraction is applied during the application of traditional cage systems and as a result, an overload occurs on the endplates. According to the opposing party, on the other hand, the expanding cages reduce the graft application area and create high forces that can lead to neighboring segment fractures (2).

Currently, plated corpectomy cages are commonly used in post-tumor instability surgery. On the other hand, they are not preferred after trauma and spondylosis surgery due to their narrow graft area (2). The most common complications associated with anterior corpectomy and support graft intervention are those originating from graft/cage. Slipping and non-fusion of the graft still emerge as important problems. The grafts are displaced anteriorly, typically fracturing the underlying vertebra, which often requires revision surgery. However, use of a plated corpectomy cage has benefits such as preventing the cage from malpositioning posteriorly and shortening the operation time and low cost compared to placing an extra plate on the normal cage used without a plate.

Pseudoarthrosis is the most important late complication of fusion surgery. Liu et al. reported in their systematic review and meta-analysis that 27 (8.1%) of 330 patients who underwent anterior cervical intervention were re-operated due to pseudoarthrosis (3). Wada et al. reported that there was a significant relationship between pseudoarthrosis and the number of fused segments, and the incidence of pseudoarthrosis increased as the number of fused segments increased (4). In these large-scale studies, the authors state that in patients who require decompression and fusion of three or more segments, the most important drawback is the possibility of developing pseudoarthrosis. Therefore, the most important radiological finding that is expected to occur in a follow-up of a stabilized vertebral segment is the occurrence of fusion.

The large contact surface of the cages and grafts used in fusion with the vertebral bodies accelerates the fusion. There are many publications showing the usefulness of plate in multilevel fusions and successful fusion rates (5,6). Various research report that a high rate of pseudoarthrosis is obtained if no plate is used in 2-level anterior cervical fusion, and high fusion rates are obtained if used. (7,8). Less graft area can be considered as a disadvantage in the use of plated corpectomy cages. However, long-term radiological follow-up of the patients prove that, since the surface area of the graft vertebral body is wider in our method, new bone formation is observed in the anterior and posterior wall of the cage, not only in the limited area with the graft placed in the cage.

Microscopic bone extensions formed in the first stage of the fusion should not be broken in the early period. Later, these structures will be fed by neighbouring veins and the bones that provide the fusion will strengthened. For this reason, in the first period immediately after the surgery, the surfaces to be fused are desired to remain immobile, and a neck collar is recommended to the patients for at least the first 3 weeks following the fusion surgery to ensure immobility. Long-term use of neck brace causes weakness in neck muscles and chronic neck pain in the following period. In the technique we use, calcium phosphate cement begins to freeze in 2 minutes after the intervention and is 100% frozen in the first 24 hours (Table 1). For this reason, it allows patients to use a shorter postoperative brace. We think that this may bring us the early onset of fusion and avoidance of chronic neck pain secondary to muscle atrophy. In addition, with the graft prepared by mixing cement with autograft, the dispersion of the autografts to be placed freely is prevented and complications such as nerve/cord compression can be prevented.

Table 1. Mixing and injection of Axoz Qs.

Preparation time	Injektion/ working time	'no touch' time	Hardening time
2 minutes	2 minutes	8 minutes	After 12 minutes (25%) After 2 hours (50%) After 24 hours (100%)

It has been emphasized that by providing a larger graft area with the graft placement technique we have implemented, disadvantage of the existing narrow graft surface area of the corpectomy cage can be eliminated and the risk of pseudoarthrosis can be reduced by increasing the fusion rate.

Yazarlık Katkısı: Fikir/Hipotez: HKA, AGG Tasarım: HKA, AGG Veri Toplama/veri işleme: HKA, AGG Veri Analizi: HKA, AGG Makale Kontrolu: HKA, AGG Makale Yazımı: HKA, AGG

Etik Kurul Onayı: Gerekli değildir.

Hasta Onayı: Olgu sunumu için hastadan izin alınmıştır.

Çıkar Çatışması: Yazarlar tarafından çıkar çatışması bildirilmemiştir.

Finansal Destek: Yazarlar tarafından finansal destek almadıkları bildirilmiştir

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