Case Report

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Root Compression Due to Swollen Oxidized Regenerated Cellulose after Cervical Disc Surgery

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ABSTRACT

Oxidized regenerated cellulose is a hemostatic material that is frequently used in neurosurgery. While it is often left in place to avoid postoperative hematoma, in rare cases it may cause neural tissue compression. A case with severe radicular pain due to swollen oxidized regenerated cellulose after anterior cervical disc surgery was reported.

A 37-year-old female was operated for a C5-6 disc herniation. After anterior microdiscectomy, severe radicular pain developed due to a retained piece of swollen oxidized regenerated cellulose. Complaints resolved completely after removal of the material causing the compression.

Neurological deficits may develop with even a small amount of oxidized regenerated cellulose left behind on the surface of the dura after spinal surgery. We need to keep in mind that this is foreign material that should be used in small quantities. If possible, it must be removed after hemostasis has been achieved.

Keywords: Cellulose oxidized, nevre root compression, postoperative complication

ÖZET

Servikal disk cerrahisi sonrası şişmiş oksidize rejenere sellüloza bağlı kök basısı

Oksidize rejenere sellüloz nöroşirürjide sık kullanılan kanama durdurucu bir maddedir. Ameliyat sonrası hematomları önlemek için sıklıkla ameliyat sahasında bırakılırsa da, nadiren nöral doku basısına neden olabilir.

Anterior servikal disk cerrahisi sonrası şişmiş oksidize rejenere sellüloza bağlı şiddetli kök ağrısı olan bir olgu sunuldu.

Otuz yedi yaşında bir kadın C5-6 disk hernisi nedeniyle ameliyat edildi. Anterior mikrodiskektomi sonrası şişmiş bir parça oksidize rejenere sellüloza bağlı şiddetli kök ağrısı gelişti. Bası yapan maddenin çıkarılmasından sonar yakınmalar tamamen geçti.

Spinal cerrahide dura üstünde bırakılan küçük bir parça oksidize rejenere sellüloz bile nörolojik yakınmalara neden olabilir. Bu nedenle, oksidize rejenere sellülozun bir yabancı madde olduğu unutulmamalı, küçük miktarlarda kullanılmalıdır. Mümkünse hemostaz sağlandıktan sonra çıkarılmalıdır.

Anahtar kelimeler: oksidize selüloz, sinir kökü basısı, postoperatif komplikasyon

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Introduction

Oxidized regenerated cellulose (ORC) is a hemostatic material that is frequently used in neurosurgery. This material is prepared by dissolving, regenerating and oxidizing a pure form of α-cellulose (1). Absorption of ORC starts within 24 hours, multinucleated giant cells are observed within one week (2), and ORC is wholly absorbed within 4 to 8 weeks (3). Therefore, it is often left in place to avoid postoperative hematomas. Although ORC is bioabsorbable, various complications after its retention at the operative site have been reported in the literature. ORC may mimic a hematoma, abscess or tumor.

A case with severe radicular pain due to swollen ORC after anterior cervical disc surgery is reported.

Case Report

A 37-year-old woman who had been operated for C6-7 disc herniation 9 months earlier was admitted with neck and left

arm pain for 2 months. Her neurological examination revealed elbow flexion paresis with 4/5 muscle strength and left C6 dermatomal hypoesthesia. A cervical magnetic resonance imaging (MRI) study showed left paramedian soft disc herniation at C5-6 level (Figure 1a and b). Given that her severe pain had not resolved with conservative management for 2 months, anterior C5-6 discectomy was performed. An epidural bleeding developing after removal of the disc fragment was controlled with a piece of ORC and gentle compression with sponge. Because bleeding restarted when the ORC was removed, a small piece of ORC was left behind. An intervertebral cage filled with demineralized bone matrix was inserted.

The left arm pain of the patient had diminished by the time she recovered postoperatively; however, 1 to 2 hours after

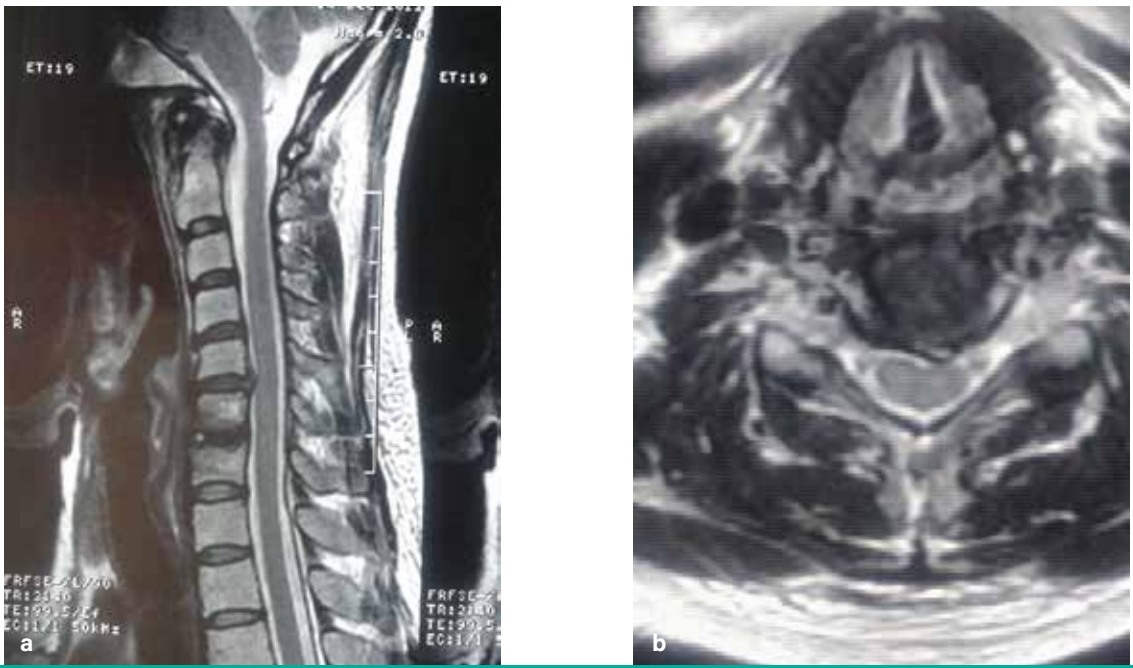

Figure 1: Preoperative sagittal (a) and axial (b) T2-weighted cervical MRI sections revealed left paramedian soft disc herniation at the C5-6 disc level.

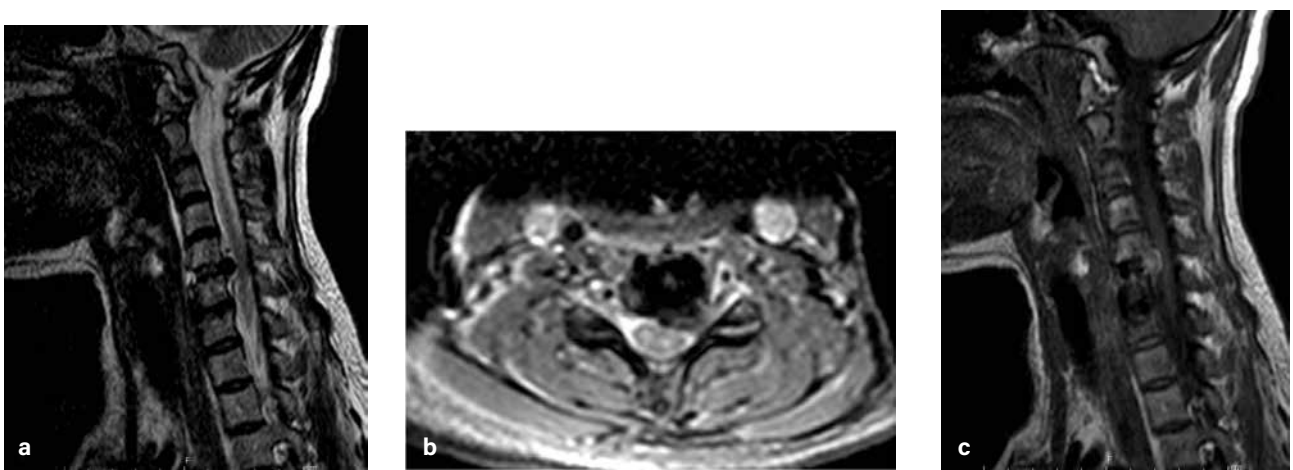

Figure 2: Cervical MRI study performed the day following the first operation. Sagittal (a) and axial (b) T2-weighted MRI sections reveal a hypointense rounded well-demarcated mass compressing the C6 nerve root and spinal cord. On the T1-weighted sagittal MRI section (c), the lesion is isointense with the intervertebral disc with a hyperintense rim surrounding the lesion.

Figure 3: Swollen ORC pieces removed from the anterior epidural space at the C5-6 level.

operation she complained of severe left arm pain again, and her pain gradually increased within a few hours. Neurological examination was similar to the preoperative state. Because pain was very severe the next day, a control cervical MRI was performed. It revealed a round mass showing isointensity relative to the disc, peripheral hyperintensity on T1-weighted images and hypointensity on T2-weighted images in the left posterior paramedian region of the C5-6 disc, compressing the C6 nerve root and spinal cord (Figure 2a, b and c). It was thought to be a postoperative hematoma. The patient was re-operated and a swollen ORC was extracted from the anterior epidural space (Figure 3). There was no disc fragment or hematoma. The cage was reinserted. After the second operation, the patient had no complaints. Control cervical MRI revealed that there was no material compressing the root or spinal cord at the C5-6 disc level.

Discussion

Oxidized regenerated cellulose is one of the most frequently used hemostatic materials in neurosurgical operations. It supports hemostasis in various ways, including mechanical action as a tamponade, blood absorption leading to swelling and gel formation, surface interaction with proteins and platelets, activation of intrinsic and extrinsic pathways, and acting as a caustic by decreasing the local pH and denaturating globulin and leading to the production of acid hematin (4). Moreover, it has been suggested that it is bactericidal for multiple strains (5). In spinal surgery, bleeding originating under the sac or root often cannot be controlled by direct coagulation but may be diminished or stopped by packing with a piece of ORC. It is recommended to remove ORC instead of leaving it behind after hemostasis is achieved if possible (1,6); however, ORC is frequently left behind in the surgical field.

Although ORC is a bioabsorbable material, various complications after its retention at the operative site have been reported. It may mimic an abscess or a recurrent tumor in the late postoperative period (7-9). Also, there are several reports of neural compression due to retained ORC after cranial, orbital, spinal, or thoracic surgeries within a few days (1,5,10-15). ORC swells and takes on a gelatinous consistency when it is in contact with blood. Within an enclosed space, it can exert considerable compressive force (1). Therefore, when ORC is used to help hemostasis in small cavities with bony walls such as spinal canal or optic foramen or around the chiasm, it may become swollen and compress the neural tissue. Most of the cases with postoperative neural tissue compression due to swollen ORC were reported after thoracotomies. However, this complication very rarely occurs after spinal disc surgery, too. In the literature, there are only two cases of ORC causing neural compression after lumbar discectomy (4,5), one case after decompression for lumbar spinal stenosis (16), and one case after cervical disc surgery (17). In all of these four cases, neurological signs and symptoms worsened and reoperations were performed one day after surgery like in our case.

On MRI studies, retained and swollen ORC was seen as a rounded, well-defined mass with marked hypointensity on T2-weighted images (1). Oto et al. (18) reported that this marked hypointensity is the most useful MRI criterion for retained ORC. Swollen retained ORC causing neural compression can be confused with postoperative epidural hematoma. Acute hematomas are also hypointense on T2-weighted images with isointensity on T1-weighted images, but this hypointensity is not as marked as in the ORC (19). A thin peripheral rim of hyperintensity may be noted on both T1- and T2- weighted images. This was thought to represent postoperative fluid either within or around the ORC (18). No enhancement is noted after administration of gadolinium (1). However, other imaging characteristics were reported in some papers. In the case presented by Partheni et al. (4), the ORC was shown as an isointense – with respect to the disc – rounded mass visible on axial T1-weighted images, appearing inhomogeneous with a central isointense core including some focal low signal areas

and some high signal areas on T2-weigthed images. The focality of the lesion on MRI also differentiates it from an epidural hematoma, which would have appeared more spread out around the cord and not as such a focal mass (20).

Awwad and Smith (10) evaluated immediately postoperative MRI studies following lumbar laminectomy in 10 patients and reported that marked spinal canal compression can be a normal finding in the immediately postlaminectomy period in patients with retained ORC. The majority of mass effect resulting in severe spinal canal stenosis postoperatively most likely resulted from fluid accumulation adjacent to the ORC. They concluded that the MR appearance in such instances is not significant in the absence of compressive clinical symptomatology.

Treatment of retained ORC causing neural compression is its surgical removal. Although epidural hematomas may, in some cases, be managed conservatively and allowed to resorb, masses of ORC must be removed if they are causing neurologic deficits (20). If removed immediately, neurological deficits may improve completely. However, there were some cases with permanent deficits in spite of removal of the ORC (19). In most of the cases, signs and symptoms develop within a few hours after surgery and worsen over 24 hours. However, there were some cases where findings worsened after 2 days (20). Swelling of the material may continue after the appearance of these symptoms, and neural compression caused by swollen ORC may worsen. Therefore, early recognition of the pathology and early treatment are essential.

In conclusion, ORC routinely used in spinal surgery to achieve hemostasis may cause neural compression. Neurological deficits may develop with even a small amount of ORC left behind on the surface of the dura after spinal surgery. We need to remember that ORC is a foreign material to be used in small quantities. If possible, it must always be removed rather than being left behind after hemostasis has been achieved.

If neurological signs and symptoms develop due to a swollen retained ORC, diagnosis can be made looking for its well-shaped rounded appearance with marked hypointensity on T2-weighted MRI sections and with a hyperintense rim surrounding the mass on T1-weighted MRI sections. Early treatment for its removal may generally lead to an improvement of the neurological findings.

Contribution Categories	Name of Author
Follow up of the case	A.T., A.T., M.Y., C.I., O.A., M.V., Y.H., F.K.G.
Literature review	A.T., F.K.G., A.T., M.Y., C.I., O.A., M.V., Y.H.
Manuscript writing	A.T., C.I., O.A., M.V., Y.H., A.T., M.Y.
Manuscript review and revisation	F.K.G.

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