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Case Report

Delayed cauda equina compression after spinal dura repair with BioGlue: magnetic resonance imaging and computed tomography aspects of two cases of ‘‘glue-oma’’

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Abstract

BACKGROUND CONTEXT: Bovine serum albumin and glutaraldehyde (BSAG) (BioGlue) is a surgical adhesive widely used for off-label applications in neurosurgical procedures to minimize the risk of cerebrospinal fluid leakage after dural closure.
PURPOSE: To describe magnetic resonance imaging (MRI) and computed tomography (CT) aspects of two cases of postoperative BSAG expansion causing delayed cauda equina compression requiring further surgery.
STUDY DESIGN: A case report.
PATIENT SAMPLE: Two cases of delayed cauda equina compression complicating the closure, with BSAG, of small unintentional tears in the dura requiring lumbar decompressive surgery.
OUTCOME MEASURES: They included postoperative CT and MRI findings.
METHODS: We compared postoperative imaging and perioperative findings during subsequent surgery.
RESULTS: In both cases, imaging showed cauda equina compression due to epidural masses found during subsequent surgery comprising BioGlue. These masses appeared slightly hyperdense on CT scans and markedly hypointense on T2-weighted MRI scans.
CONCLUSIONS: When applied as a thick layer during use as a dural sealant, BSAG may swell, leading to a symptomatic ‘‘glue-oma’’ giving a hypointense image on T2-weighted MRI scans.

Keywords: Dural closure techniques; Dural sealants; BioGlue (BSAG: bovine serum albumin and glutaraldehyde polymer); Spinal surgery; MRI; Cauda equina compression

Introduction

BioGlue (CryoLife, Atlanta, Georgia, USA) is a surgical sealant consisting of bovine serum albumin and glutaraldehyde (BSAG) that polymerize within 20 to 30 seconds when mixed [1]. According to the information supplied by the manufacturer, BioGlue is indicated for use as an adjunct to standard methods of achieving hemostasis, such as sutures and staples, in adult patients undergoing open surgical repair of large vessels (such as the aorta or the femoral and carotid arteries). Despite the warning ‘‘BioGlue for use in neurosurgery, including use as a dural sealant, is not an approved indication’’ given in the information leaflet provided by the manufacturer, this product is frequently used in off-label applications in neurosurgical procedures to minimize the risk of cerebrospinal fluid (CSF) leakage after dural closure [2,3], particularly in reconstructions of the sellar floor after transsphenoidal adenohypophysectomy [4]. Its use in spinal surgery has also been studied in a short series of patients with unintentional damage to the dura mater inflicted during uninstrumented lumbar spine surgery [2,5,6]. In both the Adverse Event Reporting and

FDA device/drug status: Not approved for this indication (Bioglue; Cryolife, Atlanta, Georgia, USA).

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Manufacturer and User Facility Device Experience databases, the expansion of BioGlue into an unintended site is one of the events most frequently reported after the use of BioGlue in dural repair [7]. We present two cases of postoperative cauda equina compression due to BioGlue swelling after spinal dural repair and discuss the computed tomography (CT) and magnetic resonance imaging (MRI) criteria for the diagnosis of this complication, which is known as a ''glue-oma'' [8].

Case 1

An 81-year-old man consulted in February 2012 for left L5 radicular pain of two months' duration that did not respond to drug treatment. His medical history included surgery for L3/L4 disc herniation in 1999. Neurologic examination at the time revealed a mild paresis of dorsal flexion and abduction of the left ankle. Lumbar spine MRI showed left L4/L5 disc herniation. A surgical discectomy via a posterior approach was performed in March 2012. Postoperative neurologic evaluations showed an improvement of the left radicular pain with no recovery of the distal paresis. A few weeks after surgery, a contralateral L5 radicular pain gradually emerged. A CT scan showed the recurrence of voluminous disc herniation at L4/L5, almost entirely blocking the spinal canal. The patient underwent a second surgical procedure, via a posterior bilateral approach, in December 2012. During this procedure, CSF fluid leaked through a tear in the dura mater on the anterior

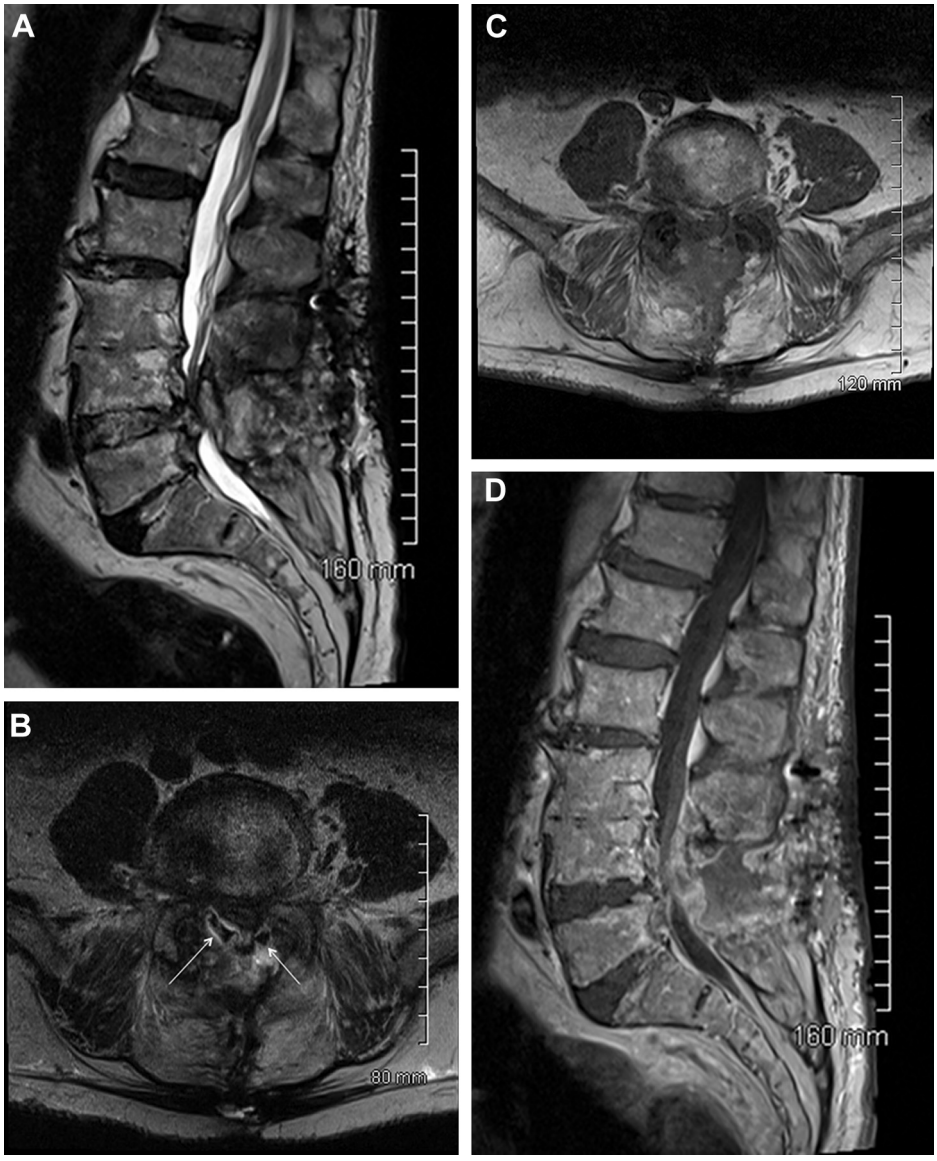

Fig. 1. (A) T2-weighted sagittal and (B) axial images obtained on Day 17 demonstrating cauda equina compression at L4/L5 due to frank hypointense masses surrounded by areas of hyperintensity (B, arrows). These epidural masses were isointense on T1-weighted images relative to the intensity of the cerebrospinal fluid signal (axial image, C), with mild peripheral enhancement after gadolinium administration (sagittal image, D).

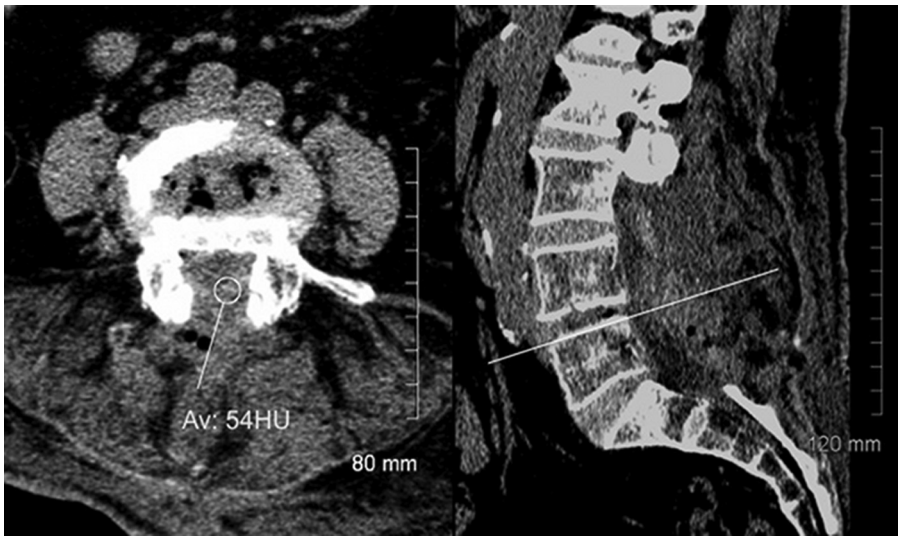

Fig. 2. Computed tomography scan on Day 5, showing thecal sac compression due to hyperdense epidural filling (between 50 and 60 UH) in the lower part of the wide laminectomy, corresponding to the area in which the dural tear was treated with BioGlue.

side of the left L5 root. Suture was not possible. The surgeon decided to treat the dura mater tear with an instillation of BioGlue. The patient was discharged on Day 8. Because of the persistence of radicular pain in the right leg, with no new neurologic deficit, the patient was readmitted to hospital on Day 13. A new lumbar spine MRI scan revealed epidural compression at L4/L5 due to a frank hypointense multiloculated mass on the T2-weighted MRI scan (Fig. 1). Another surgical intervention was carried out, during which a tough, brown epidural mass surrounding the dura mater consisting of biological glue was removed. The right L5 radiculopathy improved on analgesic treatment and the patient was discharged 6 days after the operation.

Case 2

A 73-year-old-woman consulted in December 2012 for bilateral L5 radiculopathy on walking and a decrease in walking distance. Her medical history revealed high arterial blood pressure and dyslipidemia. Neurologic examination showed paresthesia in both limbs with no motor deficit. The results of lumbar spine examination were normal. Lumbar CT scan revealed degenerative stenosis at L3/L4 and L4/L5. The patient underwent lumbar laminectomy via a posterior approach in January 2013. During surgery, the first dura mater tear was sutured and a second nonsuturable dura mater tear at L4/L5 was treated with BioGlue. Because of this complication, it was decided to perform immediate bladder catheterization. Two days after surgery, the bladder catheter

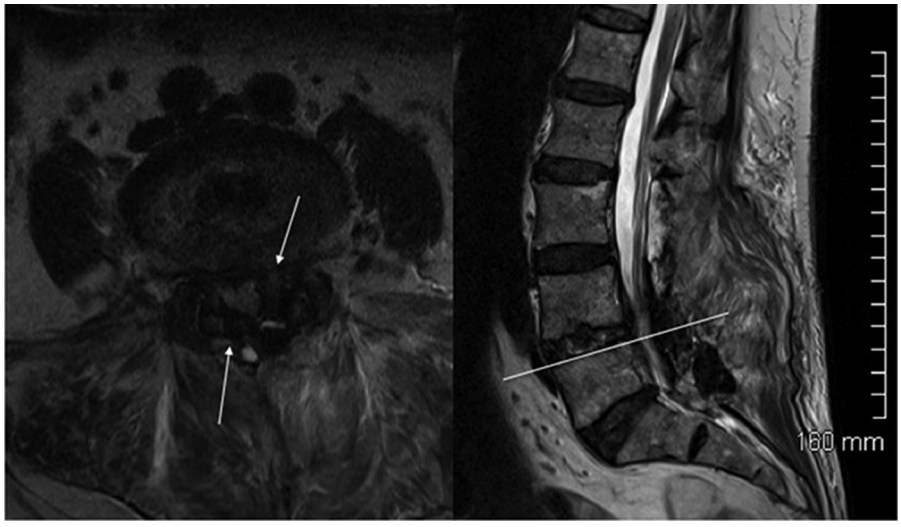

Fig. 3. T2-weighted magnetic resonance imaging scan showing cauda equina compression to be related to a peripheral epidural mass yielding a frank hypointense signal (arrows), which was found to be a ‘‘glue-oma’’ during subsequent surgery.

was removed, but immediate retention led to recatheterization. Four days after surgery, the patient presented perineal hypoesthesia. A lumbar spine CT scan (Fig. 2) showed a hyperdense mass surrounding and compressing the cauda equina at L4/L5. This mass did not resemble a classic hematoma, so the decision was taken to perform an MRI scan on the same day (Fig. 3). The patient underwent surgery immediately after MRI, during which a firm epidural mass surrounding the dura mater and causing compression was removed. The patient was discharged 6 days after surgery. Six weeks later, urodynamic explorations showed very low closure pressures and low levels of urine flow, necessitating the implantation of a permanent bladder catheter and patient education concerning autocatheterization of the bladder.

Discussion

We report here two cases of postoperative cauda equina compression because of the swelling of BioGlue after degenerative lumbar spine decompressive surgery, together with the CT and MRI findings for these patients. In both cases, CT and MRI showed cauda equina compression because of postoperative epidural collection. Thecal sac compression was because of hyperdense material (Fig. 2), but this material did not resemble a hematoma, which would have had a smooth edge and may have extended into the lateral bony recess of the spinal canal. Magnetic resonance imaging results were not consistent with a hematoma either, as the mass observed remained isointense in T1-weighted images (Fig. 1), whereas a hyperintense signal would have been expected for blood after 3 days [9]. The possibility of an epidural abscess was also considered because of the isointense epidural area on T1-weighted images, with peripheral enhancement after gadolinium administration, but the hypointense signal on T2-weighted images ruled out this possibility (Fig. 1). The epidural collection had well-defined irregular margins and was located at the site at which the BioGlue had been applied. The main feature of the observed mass was its hypointensity on T2-weighted images (Figs. 1 and 3), consistent with previous descriptions of BSAG polymer on MRI in a postoperative setting [10]. Indeed, unlike other sealants, such as fibrin glue and hydrogel that have a high water content, BSAG can be identified on the basis of its signal intensity, which is lower than that of CSF on T2 fast spin echo sequences [10]. These findings of the preoperative imaging of a dry tissue were consistent with the pre-operative observation of a tough orange-brown mass compressing the thecal sac in both cases. Fortunately, surgical removal of the BioGlue did not lead to the reopening of the dura wound, which had already healed by the surgical reintervention, and the neurologic status of the patient improved after cauda equina decompression. In our cases, the diagnosis was also supported by converging clinical arguments: the repair of a dura mater wound with BioGlue during a previous surgical procedure; delayed cauda equina compression is rare for a postoperative hematoma, particularly as the patients were not treated with antiplatelet drugs or anticoagulant; there were no clinical or biological signs of infection and no evidence for the presence of a forgotten compress at the surgical site; and the delayed swelling of BioGlue is a reported adverse effect of this surgical adhesive [7,11], particularly if applied in a thick layer [6,12]. Since these two cases, BioGlue has been used in our institution in thin layer to repair small unintended spinal dural tears with good results concerning CSF leakage, and no other case of cauda equina compression. The first implication of our findings is that radiologists should be aware of the possibility of dural compression due to swelling of this surgical sealant. A postoperative neurologic deficit or radicular pain in patients with dural wounds should lead to MRI exploration, as the material responsible for the compression cannot be clearly identified on CT scans. BioGlue is a surgical adhesive that polymerizes to form a compact mass that gives a hypointense signal on T2-weighted imaging. The second implication of our findings is that surgeons should avoid applying a thick layer of sealant. The misuse of BioGlue can lead to ‘‘direct injury to nerve tissue through compression,’’ as indicated in the manufacturer’s information leaflet. On the other hand, the use of a layer of BioGlue only 1 to 2 mm in thickness appears to be a safe and effective option as a dural sealant during spine surgery, as proposed recently by Miscusi et al. [6].

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