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Case Reports

Spinal Epidural Lipomatosis - Description of the first case operated by minimally invasive access "over the top" in a patient with neurogenic claudication

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Introduction

Spinal epidural lipomatosis (SEL) is defined as an abnormal accumulation of unencapsulated adipose tissue in the spinal epidural space. It was first described by Lee et al in 1975 and although it is a relatively rare and sometimes underdiagnosed condition in occidental countries, it is a well-known pathology in Asian [1-2].

In certain situations, the volume of adipose tissue may exert direct compression over the intracanalar structures, causing a spinal canal stenosis and root compression. Clinical manifestations may be similar to degenerative stenosis, with progressive symptoms of low back pain that may irradiate to the lower limbs, accompanied by paresthesia, weakness, and neurogenic claudication gait [3].

According to it aetiology, SEL can be categorized into 5 main groups: exogenous steroid use, endogenous steroid hormonal disease, obesity, surgery-induced and idiopathic. The etiological basis of SEL should be considered on the treatment choice [1, 4].

The treatment adopted may consist on conservative or surgical approach. However, even if the first approach is conservative, about 90% of cases will be operated on, mainly if there is spinal cord compression at the thoracic level. In patients with lumbar disease, only about 65% are operated on [5].

For patients undergoing corticotherapy, the reduction or discontinuation of medication may gradually reduce the associated neurological effects. Similarly, patients with primary endocrinological disease may have remission of symptoms after clearing the underlying disease, such as obese patients after a significant reduction in body mass índex (BMI) [6-8].

When conservative treatment fails or when patients present with acute symptomatology associated with neurological deficit, surgical treatment is usually adopted [9-10]. As Keonhee Kim et al [1] shows in his study, the surgical treatment consist in laminectomy only, without removal of epidural fat. On the other hand, in comparison with other reviewed cases, in which laminectomy was performed with removal of excess adipose tissue, it was considered that this option is the most acceptable for patients with acute compression or in those who have failed conservative management [1].

Nevertheless, some studies argue that because of the possible instability that can be generated after the laminectomy, it becomes necessary to make spinal fusion [11].

Given this rare pathology, the authors propose to describe a surgical technique that allows the direct decompression of the duro-radicular structures, by a minimally invasive approach, without the need for bone decompression that would induce a possible risk of instability.

Case Report

The authors report a case of a 66-year-old male patient with a clinical history of hypercholesterolemia and BMI 32.2, who was referred to Neurosurgery consultation for presenting gait claudication, with about 2 years of evolution and progressive deterioration, mostly in the previous 3 months. He also reported paresthesia in L5 and S1 dermatomes bilaterally and had a 4+/5 strength in his lower extremities.

A lumbosacral magnetic resonance imaging (MRI), was performed which revealed at T1 and T2 weights a central-canal positioning of the dural sac at L4 and L5 in the sagittal plane. In the T1-weighted axial plane, a dural-radicular square stellate pattern was observed at the site of greater stenosis, with the presence of adipose epidural tissue conditioning the above mentioned stenosis of the dural sac. At the adjacent levels, it is possible to observe dilatation of the dural sac by the cerebrospinal fluid (see image 1).

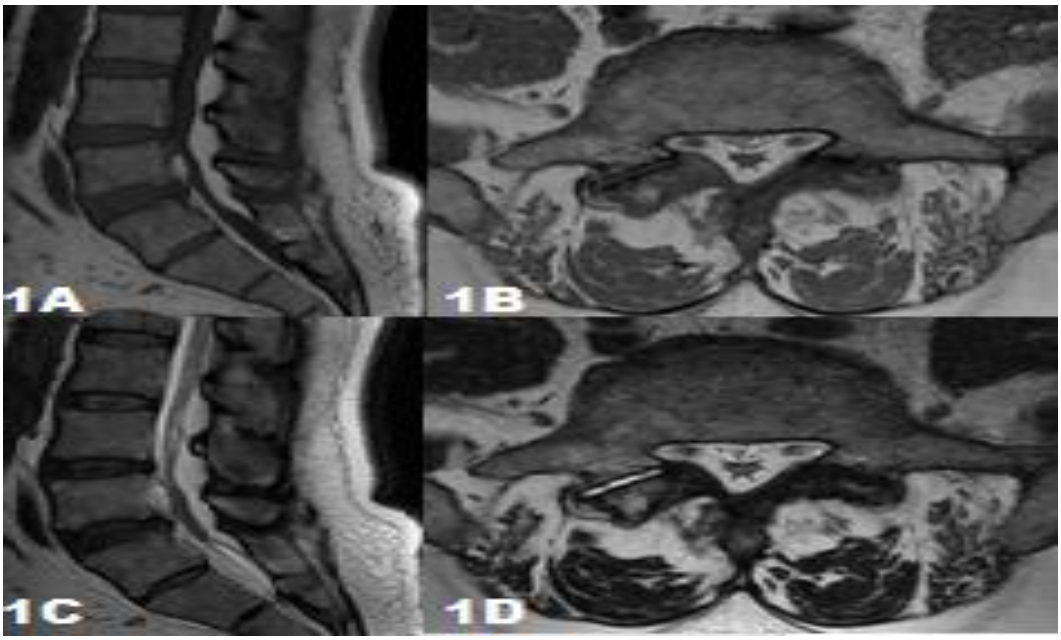

Image 1: **A -** (T1-MRI, sagittal) Epidural hyperintense image anterior and posterior to the dural sac, compatible with adipose tissue and central position of the dural sac at L4 and L5; **B -** (T1-MRI axial) square stellate formation of the dural sac, at L5; **C -** (T2-MRI, sagittal), radicular divergence below L5; **D -** (T2-MRI axial) convergence of the dural sac, with the absence of cerebrospinal fluid, at L5.

Conservative treatment with weight and cholesterol reduction was tried, but after 6 months the symptoms persisted. After the analytical study, there was no endocrinopathy and surgical treatment was chosen.

In order to achieve decompression of neurological structures in the L4L5 and L5S1 levels, unilateral minimally invasive approach with bilateral decompression was planned.

For this purpose, with the patient under general anesthesia, in prone position and with the aid of fluoroscopy, a skin incision of 3 cm of longitudinal length was made, 1.5 cm from the midline to the left. After a paramedian incision in the muscular aponevrosis, a blunt dissection of the muscular plane was performed in order to obtain an ipsilateral posterior arc exposure centered on the L5 lamina. With the support of microscopy, a left L5S1 fenestration was initially performed, with contralateral removal of the yellow ligament, preserving the interspinous ligament. After exposure of the epidural adipose tissue, a dissection of the plane between the lipoma and the dura mater was performed, with easy detachment between the structures. As a safe dissection plan was obtained, adipose tissue was removed with the aid of a *rongeur*-type microsurgical disc forceps.

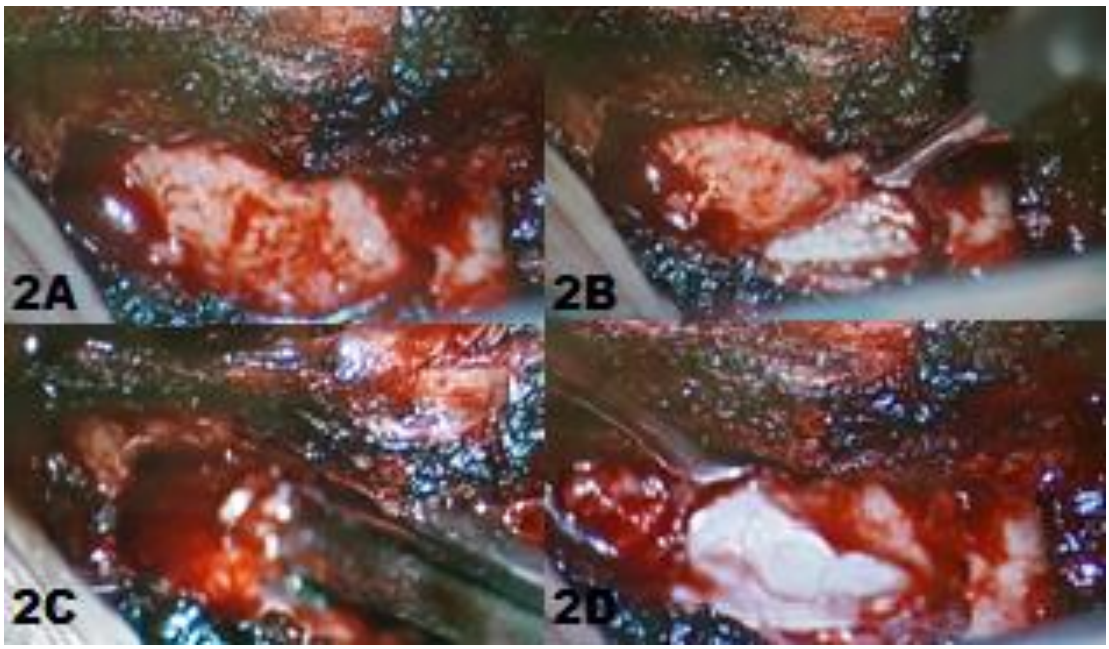

Image 2: (Intraoperative steps): **A** - exposure after left L5S1 fenestration; **B** - Tecal exposure after dissection of planes between adipose tissue and duramater; **C** - Removal of adipose tissue; **D** - Dura-mater after posterior homolateral decompression.

After removal of the adipose tissue posteriorly to the dura mater, dissection and removal of the fat was performed on the left (homolateral). With the space created by the decompression it was allowed to gently mobilize the dural sac and the roots, in order to perform a contralateral approach "*over the top*" and finally the ventral component to the dura mater, obtaining the lesion removal in these compartments. The procedure was also performed in the L4L5 space by simple and precise upper soft tissue retraction. After a microscopic total removal of intracanal adipose tissue, dural sac dilation was verified. During the procedure an easily dissection between planes was noted, facilitated by the avascular nature of the removed tissue. No complications were reported during surgery or postoperatively.

After surgery the patient had a very favorable clinical improvement, with recovery of walking ability, without claudication, only with residual low back pain (VAS 2/10) and with discharge at day 1 pos op.

Histopathological results were compatible with non-encapsulated adipose tissue.

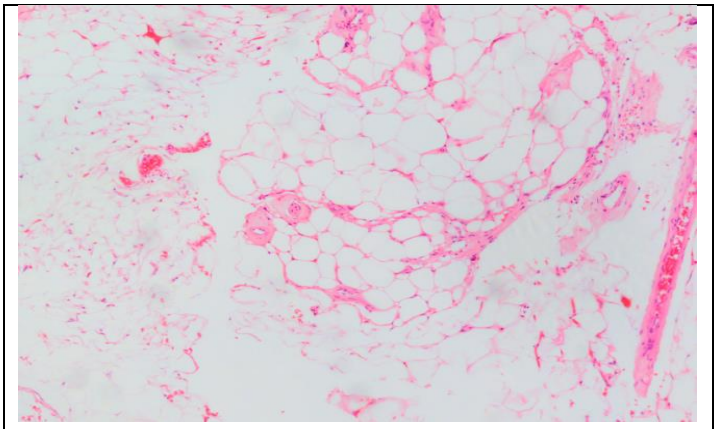

Image 3: Histology images with hematoxylin-eosin (HE) staining and magnification (20x): non-encapsulated adipose tissue.

At 30-day evaluation the patient presented no neurological deficits, no low back pain and favorable healing of the surgical wound.

Image 4: Surgical wound after 30 days of surgery, with optimal healing.

Patient underwent control lumbosacral-MRI at the end of first month which revealed adequate central canal decompression without significant muscle injury.

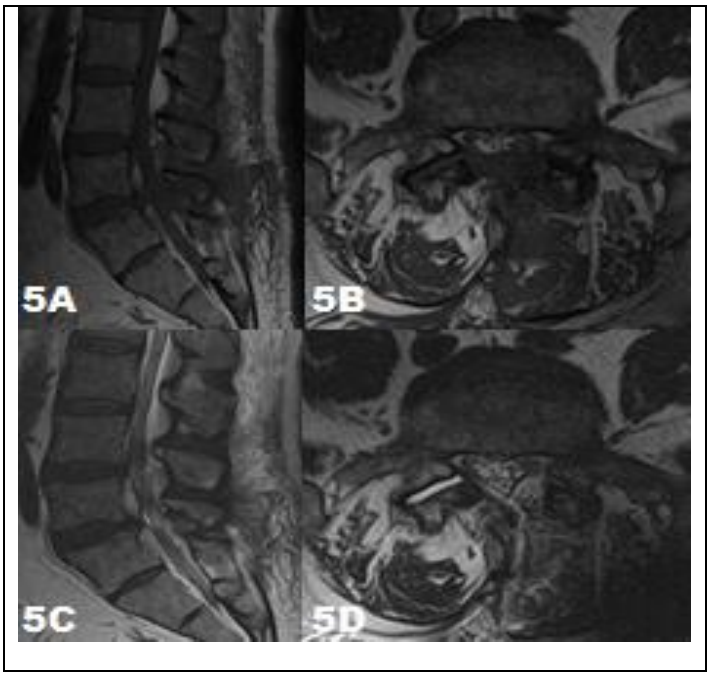

Image 5: (1-month post-operative image) A and C (T1 and T2-MRI, sagittal) decompression of the dural sac without deformation conditioned by adipose tissue; **B -** (T1-MRI axial) absence of adipose tissue surrounding the dural sac (area of hypointense corresponding to post-surgical fibrosis); **D -** (T2-MRI axial) absence of adipose tissue deforming the dural sac and visualization the intradural contents, namely the roots and CSF.

Discussion

Spinal epidural lipomatosis is a clinical entity characterized by the excess accumulation of adipose tissue in the spinal epidural space, with consequent compression of neurological structures.

Depending on the possible causes that may be associated (corticosteroid therapy, endogenous steroid endocrinopathy, obesity, previous local or idiopathic surgery), the patient's treatment should be guided by specific factors [1]. The first line of treatment should be targeted to the underlying cause, with surgery reserved for cases refractory to conservative treatment or when the neurological deficit has an acute or severe presentation [1].

Regarding conservative treatment, Robertson et al published an article recommending a weight loss of 15 kg in patients with SEL to control symptoms [12]. In patients with suspected obesity-induced SEL, weight loss appears to be effective in controlling symptoms [5].

In the most recently published study on conservative treatment of SEL, Nagahama et al, describes the case of a 51-year-old female patient who presented with gait claudication and reduced lower limb strength. She had hypercholesterolemia and a BMI of 36.8. Although the surgical decompression was considered, conservative treatment was adopted, so that after 4 months the patient had a reduction in BMI to 31.8 (lost 13.6kg in weight). There was a pain remission, maintaining a strength of 4 + / 5, similar to the initial clinical condition. In control MRI, fat accumulation in the epidural space was reduced [13].

In patients with endocrinopathy or use of exogenous steroids, correction of the underlying cause (resection of endocrinal tumor ...) should be attempted, and patients with symptom relief after control have been reported in the literature [7].

In 2018, Walker et al published, an algorithm that allows to calculate the volume of adipose tissue in the epidural space. The relevance of this tool is related to the measurement of adipose tissue volume and is a possibility to objectively confirm the response to conservative treatment. In this study, it was also found that the accumulation of adipose tissue is more frequent in the lower spine segment (L4 -L5-S1) [14].

In the other, there are several studies reporting that patients may have a fast recovery and pain relief after surgical decompression [9, 10, 15]. In most reviews and published series, the surgical option always involves decompressive laminectomy. According to Ferlic et al, laminotomy is also effective in symptomatic pain relief of patients [15].

However, there are no cases described in the literature that refer a lumbar canal decompression, without lamina removal. Also, there is no reference to minimally invasive surgery to remove epidural lipomatosis at 1 or 2 affected levels. It is in this sense that this article arises, as the purpose of the authors is to demonstrate another safe and effective surgery approach.

Based on the case presented in this article, the authors demonstrate that, in a patient with epidural lumbar lipomatosis with symptoms refractory to conservative treatment, whose location of fat accumulation obeys a prevalent topography (L4L5 and L5S1) described in the literature [14], is viable to perform a unilateral minimally invasive surgery without lamina removal. This approach is centered on the L5 lamina and allow to perform, under microscopy, a homolateral fenestration with complete flavectomy, safe dissection and intracanalar adipose tissue removal. With a simple cranial or caudal soft tissue retraction, it is possible to approach the level adjacent to the first approach. With this technique it is possible to perform a recalibration of the lumbar canal, with removal of the compressible adipose mass safely, with the advantages of: smaller incision, lower risk of infection, less blood loss, less back pain in the post-operative and less risk of spinal instability, specially because the majority of the patients are overweight, because the osteoarticular structures fundamental to stability were not altered.

Conclusion

Spinal epidural lipomatosis is a multifactorial clinical entity characterized by the accumulation of adipose tissue in the epidural space, most prevalent at L4L5 and L5S1 levels. Its treatment begins by identifying and controlling the causal factors of the disease, and when it is not possible to improve the clinical condition or when it is severe or acute, surgery is indicated.
The present article demonstrates the adaptation of the unilateral minimally invasive spinal surgical technique *over the top* to remove lipomatosis, achieving effective decompression and rapid clinical recovery of the patient.

Limitations

For technical reasons, the images of the rest of the surgery, namely the over the top approach, were lost, so they could not be presented in this article.

Declaration of Conflicting Interests

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