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CASE REPORT

A rare clinical presentation of lumbosacral radiculopathy: Denervation pseudohypertrophy of bilateral calf muscles

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ABSTRACT

Denervation from various conditions typically results in muscular atrophy; in contrast, a paradoxical volumetric increase can also rarely occur in affected muscles, which is called denervation pseudohypertrophy. Although this condition may potentially affect any muscle group, it is most commonly seen in the calf muscles. When evaluating patients with painless calf muscle enlargement, denervation pseudohypertrophy is an important differential diagnosis that should be considered. Radiological imaging methods and electromyography (EMG) are useful for differentiating pseudohypertrophy from muscular hypertrophy. Identifying denervation pseudohypertrophy requires multidisciplinary evaluation. Alongside radiological imaging and EMG findings, patient's detailed medical history and physical examination remain essential components of the diagnostic process. In this case report, we aim to present a 73-year-old man with bilateral calf muscle denervation pseudohypertrophy due to S1 radiculopathy, along with the relevant literature.

Keywords: magnetic resonance imaging, denervation, pseudohypertrophy, calf muscles, radiculopathy

INTRODUCTION

Muscle denervation may occur due to various conditions, ranging from trauma and metabolic neuropathies to autoimmune and infectious causes, and radiculopathy (1,2). Denervation in muscle tissue typically leads to atrophy in muscle fibers and reduction in overall muscle volume. In some cases, it can conversely cause volumetric increase due to fat deposition among muscle fibers. Denervation pseudohypertrophy is a paradoxical increase in muscle volume attributable to adipose tissue accumulation rather than atrophy following denervation (3). To distinguish between hypertrophy and pseudohypertrophy in muscle tissue, radiological and electrophysiological imaging techniques are used. In this article, we aimed to present a patient with bilateral calf muscle denervation pseudohypertrophy secondary to S1 radiculopathy, along with previous findings in the literature.

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CASE REPORT

A 75-year-old man presented with complaints of swelling in his lower legs for approximately one year. He also had concerns about bilateral intermittent pain radiating from the waist to the legs, along with weakness, more pronounced on the left side, that has been present for the past three years. The patient's medical history included lumbar disk herniation surgery (ten years ago), hypertension, and coronary artery disease. There was no previous history of trauma or fracture. There was no palpable focal swelling on physical examination, but a diffuse volumetric increase was observed at the level of both calf muscles, more prominent on the left. Peripheral pulses could be felt, and there was no pain with palpation.

Ultrasonography (USG) images showed increased volume and diffuse echogenicity with fibrillary pattern in the bilateral soleus and gastrocnemius muscles (Figure 1). MRI examination revealed a volume increase in the soleus and gastrocnemius muscles on both sides, hyperintensity similar to adipose tissue on T1WI and T2WI, and signal suppression on fat-suppressed images. No pathological contrast enhancement was detected on post-contrast images (Figure 2).

When the patient's previous tests were reviewed, an electromyography (EMG) examination revealed a prolonged latency in both tibial nerves, more on the left, and a decrease in the amplitude of the motor response, while no motor response was obtained in the left peroneal nerve. H reflex could not be obtained in either soleus muscle. Chronic neurogenic involvement was detected in muscles innervated by the bilateral S1 root and segment, which was moderate to severe on the left and moderate on the right. Bilateral S1 root compression was observed as an underlying cause in the lumbar MRI (Figure 3). When the patient's imaging findings, history, and EMG results were evaluated together, the findings were considered consistent with denervation pseudohypertrophy.

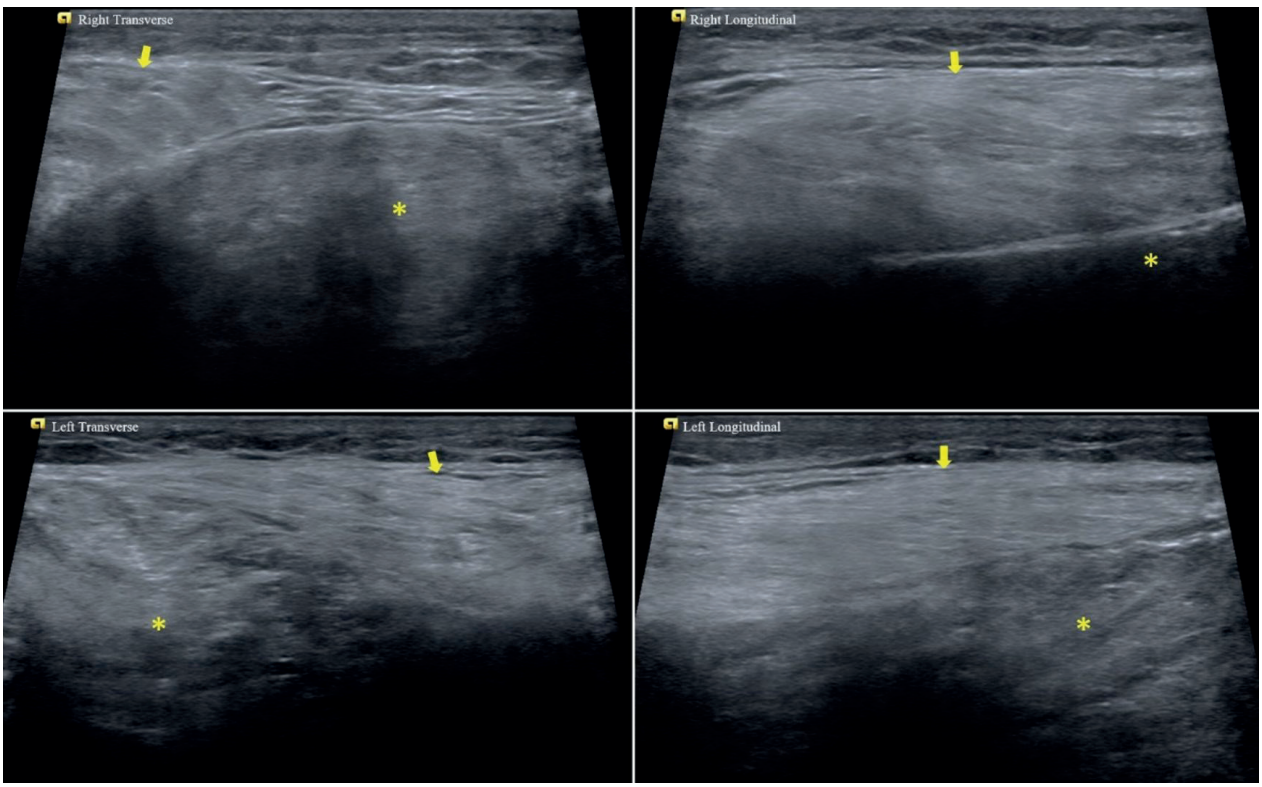

Figure 1. Ultrasonography images show an increase in volume and diffusely increased echogenicity with fibrillary pattern in the bilateral soleus (asterisks) and gastrocnemius muscles (arrows)..

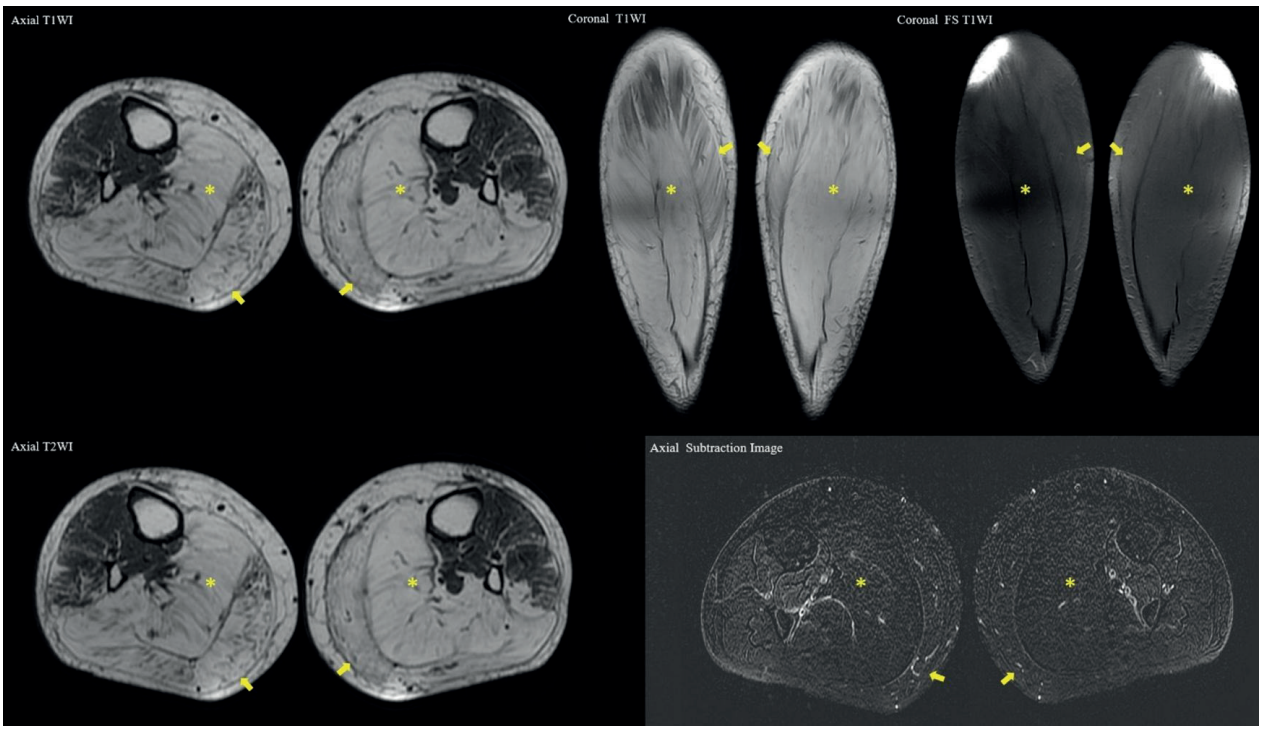

Figure 2. MRI images show hyperintensity and increased volume in the soleus (asterisks) and gastrocnemius muscles (arrows) on both axial and coronal T1W and T2W images, and signal suppression on coronal fat-suppressed T1W images. No pathologic contrast enhancement was observed on axial subtraction images.

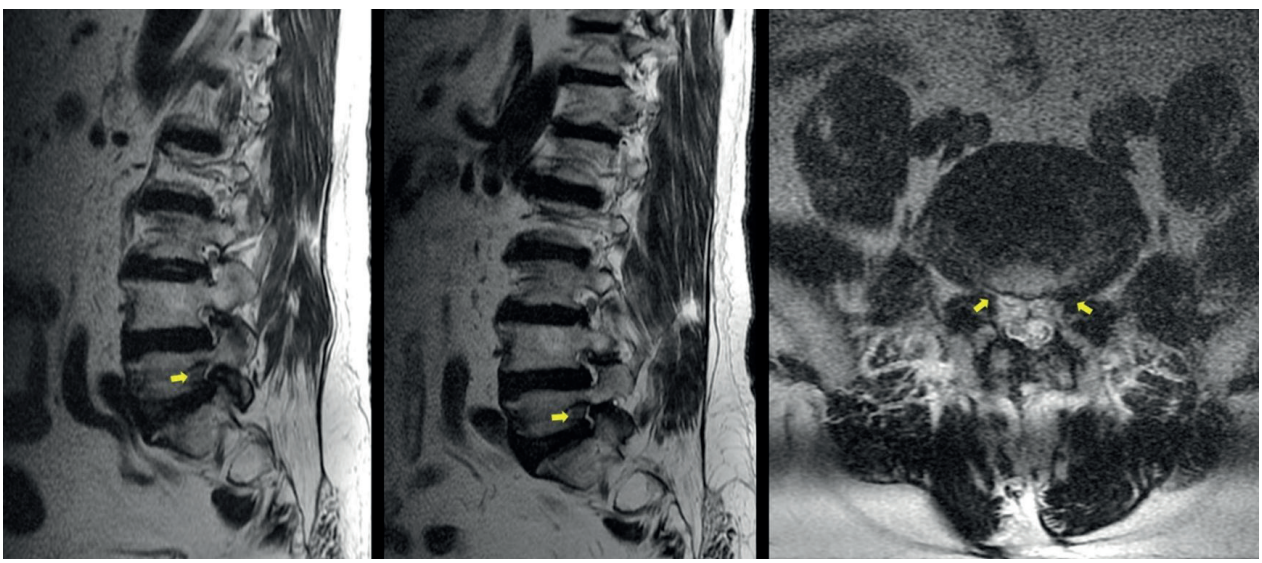

Figure 3. Sagittal and axial T2W lumbar MRI images show compression of bilateral S1 roots (arrows).

DİSCUSSİON

Conditions that cause damage to nervous tissue characteristically result in muscle atrophy due to denervation. However, pseudohypertrophy may also be observed in response to denervation, although much less frequently (2). De Beuckeleer et al. (1999) reported the pathophysiology of fatty infiltration in denervation pseudohypertrophy (4). While muscle fiber dimensions decrease after nerve damage, pluripotent mesodermal cells form lipocytes, causing fatty infiltration. Cases of denervation pseudohypertrophy resulting from various causes have been reported in the literature. Reported causes include trauma, poliomyelitis (5), muscular dystrophy (6), diabetic neuropathy (7), and radiculopathy (8). As in our case, the literature indicates that the most commonly affected muscle group is the calf muscles, and the most frequently reported cause is S1 radiculopathy (9).

Patients often present with a clinical picture of painless swelling in the muscles accompanied by muscle weakness or asymmetrical increase in the circumference of the legs. Although less common, patients may also experience fasciculations and muscle pain (9). In the literature, denervation pseudohypertrophy has usually been reported as unilateral (10). In unilateral cases, deep infiltrating intramuscular lipoma is an important differential diagnosis. Although the patient's clinical history and presentation are important guides for differentiation, histopathological evaluation may be required to make distinctions in some cases (11). In our case, unlike what is mostly reported in the literature, there was bilateral pseudohypertrophy due to bilateral chronic compression at the S1 level. In cases of bilateral pseudohypertrophy, Duchenne Muscular Dystrophy (DMD) is included in the differential diagnosis. DMD is an X-linked genetic disease, which is the most common type of muscular dystrophy in children. DMD is a progressive disorder that can affect not only skeletal muscles, but also the heart and respiratory muscles over time. This progression can cause serious complications involving the circulatory and respiratory systems, such as cardiac impairment and respiratory insufficiency, which are the major causes of death in this group of patients during early adulthood (12). In patients with DMD, the onset of symptoms during childhood and the progressive involvement of additional muscle groups are helpful findings for differential diagnosis from denervation pseudohypertrophy (3).

The main imaging finding is an increase in the size of the affected muscles and an increase in the amount of fat within the muscle, while the normal muscular fibrillar pattern is preserved. On USG, this presents as an increase in volume and echogenicity, along with preservation of the linear and feather-like fibrillar structure (4). In computed tomography, it is observed as an increase in volume and a decrease in density in the affected muscles, with preservation of its feather-like fibrillar pattern. On MRI, along with increased muscle size, high signal areas that are isointense with fat tissue on T1WI are observed within the fibrillar structure. In these areas, signal suppression occurs in fat-suppressed sequences (13). The general approach to demonstrating muscle denervation is clinical and EMG-based, but besides its diagnostic assistance, radiological imaging may also help demonstrate underlying pathologies (14).

There are no established treatment guidelines for denervation pseudohypertrophy. Although spontaneous recovery has been reported in the literature, treatment methods may include decompression surgery for the underlying cause, cortisone treatment, anticonvulsants, and botulinum toxin (9,15).

In conclusion, denervation hypertrophy is an important differential diagnosis to consider in patients presenting with painless enlargement of the lower leg muscles. The diagnosis of denervation pseudohypertrophy necessitates a comprehensive approach that incorporates clinical history, thorough physical examination, EMG, and radiological findings. MRI plays a crucial role not only in diagnostic imaging but also in revealing the underlying cause.

Ethical approval

Written informed consent was obtained from the participant.

Author contribution

Surgical and Medical Practices: ED; Concept: MB, ED; Design: MB, ED; Data Collection or Processing: OB; Analysis or Interpretation: OB, ED; Literature Search: OB, MB; Writing: OB, MB. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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