

## CLINICAL AND MORPHOLOGICAL STUDY OF CALF ENLARGEMENT FOLLOWING S-1 RADICULOPATHY

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**SUMMARY** — Calf enlargement following sciatica is a rare condition. It is reported the case of a 28-year-old woman who complained of repeated episodes of lower back pain radiating into the left buttock and foot. One year after the beginning of her symptoms, she noticed enlargement of her left calf. X-ray studies disclosed L<sup>5</sup>-S<sup>1</sup> disk degeneration. EMG showed muscle denervation with normal motor conduction velocity. Open biopsies of the gastrocnemius muscles were performed. The left gastrocnemius muscle showed hypertrophic type 2 fibers in comparison with the right gastrocnemius. Electron microscopy showed mildly increased number of mitochondria in these fibers. A satisfactory explanation for denervation hypertrophy has yet to be provided.

**KEY WORDS:** Muscle hypertrophy, calf enlargement, radiculopathy, muscular biopsy, electron microscopy.

Estudo clínico e morfológico da hipertrofia de panturrilha no curso de radiculopatia

**RESUMO** — A hipertrofia da panturrilha no curso de ciática é raramente observada. É relatado o caso de uma paciente com 28 anos de idade que apresentou episódios repetidos de dor lombar irradiada para nádega e pé esquerdos. Um ano após o início dos sintomas, notou aumento da panturrilha esquerdia. Estudos radiográficos revelaram degeneração do disco de L<sup>5</sup>-S<sup>1</sup>. O exame eletromiográfico mostrou desnervação muscular com velocidade de condução

normal. Foram realizadas biópsias dos músculos gastrocnêmios. No esquerdo notou-se hipertrofia das fibras tipo 2, em comparação ao gastrocnêmio direito. A microscopia eletrônica revelou aumento do número de mitocôndrias nas fibras hipertrofiadas. Explicação satisfatória para a hipertrofia muscular na vigência de desnervação ainda não foi definida.

**PALAVRAS-CHAVE:** hipertrofia muscular, aumento da panturrilha, radiculopatia, microscopia eletrônica.

Hypertrophy of the calf associated with sciatica is a rare condition<sup>14</sup>. Muscle hypertrophy following denervation has been studied in cases of traumatic lesion of peripheral nerve<sup>7</sup>, chronic spinal atrophies<sup>3,12,16</sup>, postpoliomyelitis syndromes, and polyneuropathies<sup>4,5,15</sup>. Lhermitte and Albessard<sup>5</sup> were the first to report a case of hypertrophy of the calf during the course of sciatica. Lapresle et al.s, in 1973, described the first muscle biopsy study in a similar case. Other morphological studies were later performed<sup>10,13</sup> showing hypertrophy of both fiber types, specially type 1 fibers.

We describe clinical and biopsy findings (light and electron microscopy) in a patient with calf muscular hypertrophy following a S<sub>1</sub> radiculopathy.

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#### PATIENT AND METHOD

NCS, a 82-year-old right-handed woman had complained of repeated episodes of low back pain radiating into the left buttock and foot since February 1988. One year later she noticed a slow enlargement of her left calf. Painful cramps occasionally occurred. No preceding physical training was reported. Family history for neuromuscular disease was negative. The neurological examination revealed diminished left plantar flexion (grade 4/5 MRC) and eversion of the foot (grade 4/5 MRC) on this side. The strength in other muscle groups was normal. The ankle jerk was absent on the left. The calf on that side was — enlarged with a circumference of 40 cm; on the opposite side circumference was 34 cm (Fig. 1) X-ray studies disclosed L<sub>5</sub>-S<sub>1</sub> disk degeneration. The electromyogram showed normal motor conduction velocity, absence of the H reflex latency on the left side, positive sharp waves and fibrillation in the left gastrocnemius muscle, and positive sharp waves in the lower lumbar left paraspinal muscles. No pseudomyotonic discharges were registered.

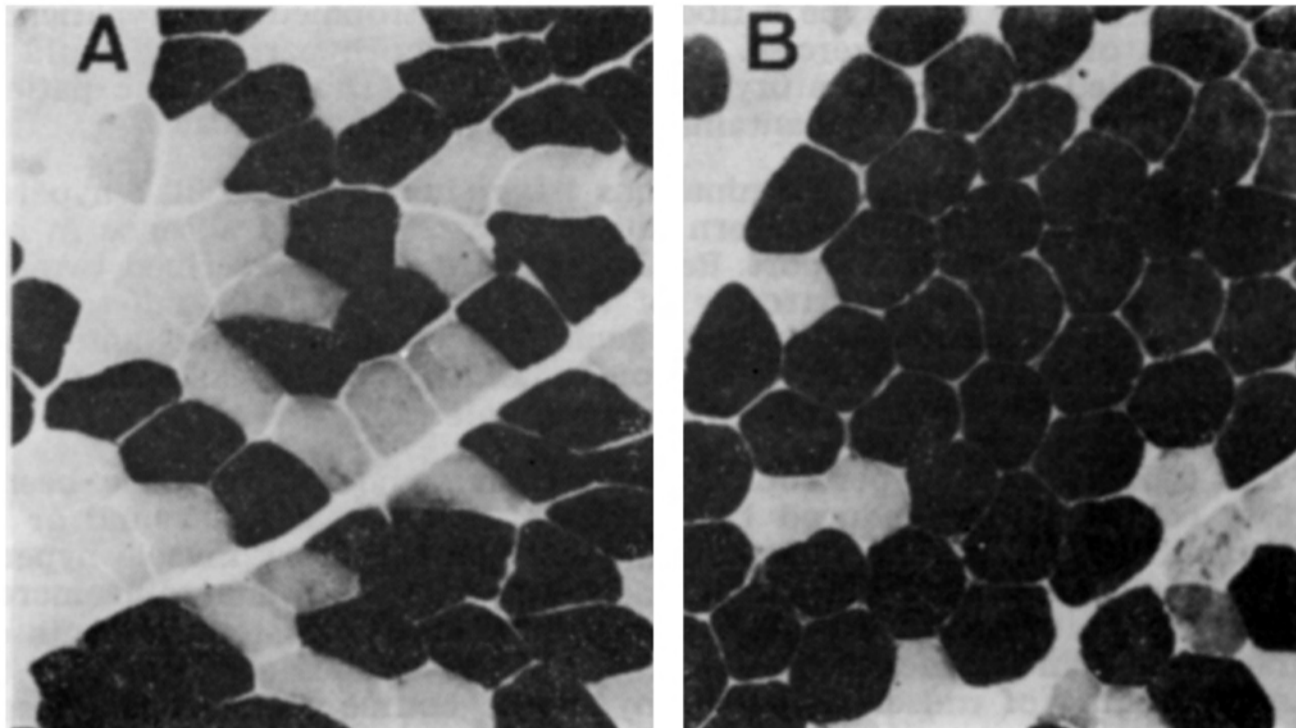


*Fig. 1. Case NCS: left calf enlargement.*

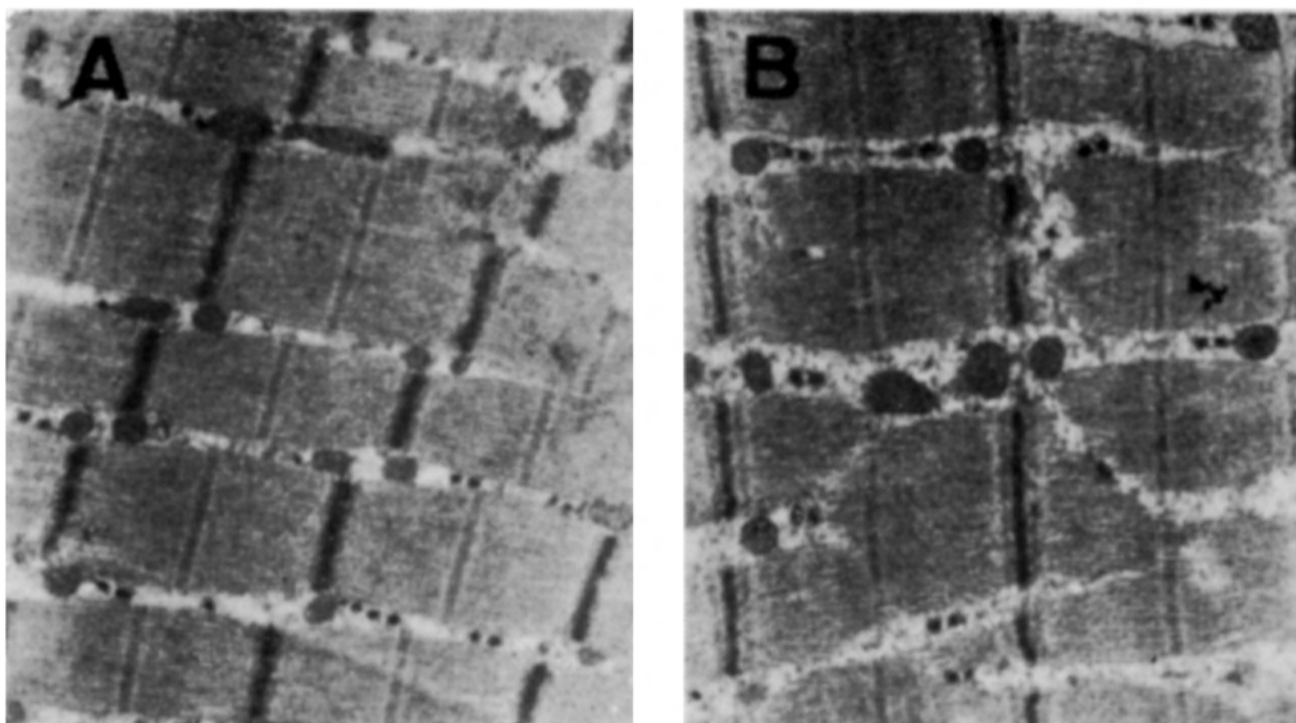
Muscle biopsies of the gastrocnemius muscle were performed on both calves. Formalin fixed and paraffin-embedded specimens were stained with haematoxylin-eosin (HE), Gomori trichrome, and periodic acid of Schiff (PAS). A second specimen of muscle was frozen in liquid nitrogen and stained for myofibrillar adenosine triphosphatase (ATPase preincubation at pH 9.4 and 4.6) and succino-dehydrogenase (SDH). A modified Gomori trichrome and HE were also used on the frozen material. A third specimen was processed for electron microscopy.

#### RESULTS

The left gastrocnemius muscle showed groups of atrophied fibers and normal sized as well as hypertrophied type 2 fibers, in comparison with the right gastrocnemius muscle (Fig. 2). Some of these hypertrophied fibers presented intense reaction in the periphery on SDH. These fibers remained polygonal. Myopathic features were not observed. Nonspecific changes were found by electron microscopy. Mitochondria had a normal aspect but appeared mildly increased in number in the hypertrophied fibers (Fig. 3) when compared with the normal fibers of the right muscle.



*Fig. 2. Case NCS: gastrocnemius muscle biopsies. In A (normal sized calf) the mosaic pattern is preserved. In B (hypertrophied calf) sample with type grouping fibers, belonging to type 2 (A and B: ATPase pH 9.4, 40X).*



*Fig. 3. Case NCS: electron micrographs (EM) of normal right (A) and left hypertrophied (B) gastrocnemius muscles. Reduced number of sarcomeres is present in B, when compared to A. A mild increase in the number of mitochondria appears to occur in B (A and B: EM, X30,000).*

#### COMMENTS

In our patient true hypertrophy of the muscle of one calf developed progressively following S<sub>1</sub> radiculopathy as described by Lapresle et al.<sup>6</sup>. There was hypertrophy of type 2 fibers exclusively with less marked signs indicating denervation. The hypertrophy of the left calf was related to the increased diameter of type 2 fibers when compared to the fibers of the right side. Previous reports of muscle biopsy findings in calf hypertrophy after partial nerve lesions concerning S<sub>1</sub> root revealed enlargement of both fibers type, mainly of type 1<sup>10,14</sup>. Predominant hypertrophy of type 2 fibers have also been reported<sup>11</sup>. The proximity of atrophic fibers with those with compensatory hypertrophy could make clear the inequality of muscle fibers size<sup>11</sup>. In our case and in the report

of Bernât and Ochoa' only type 2 fibers were hypertrophied. Their patient had a 2 year period of physical exercise. This type 2 fiber hypertrophy could be undoubtedly regarded as compensatory work-induced i.io. Diversely, our patient had no exercise program but she maintained her activity.

The electrophysiological examinations have shown a muscular hyperactivity related to the pseudomyotonic pattern in some cases 6,10, and absence in others i. ii,i4 as occurs in the present report. Recently Mattle et al.' described two patients with isolated neurogenic hypertrophy of the trapezius muscle due to accessory nerve injury and a patient with neurogenic hypertrophy of the anterior tibial muscle due to chronic radicular lesion of L<sub>4</sub>. EMG in these cases showed dense continuing spontaneous discharges of complex potentials.

The type 1 fibers hypertrophy observed in some reports have been interpreted as compensatory, induced by lesions of synergic muscles and/or muscle compartments 1'. Our findings also suggest that compensatory muscle hypertrophy of both type could appear in partial denervation 1,6,10,11. The mild increase in the number of mitochondria could express higher oxydative requirements of type 2 fibers on this chronic active denervation. Further studies are necessary for the full understanding of muscle hypertrophy in the course of neurogenic lesions.

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