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Aesthetic Resection of the Gastrocnemius Muscle in Postpoliomyelitis Calf Hypertrophy: An Uncommon Case Report

Chih-Cheng Tsai, M.D., Su-Shin Lee, M.D., Chung-Sheng Lai, M.D., Sin-Daw Lin, M.D., and Chii-Shur Chiou, R.N.

Kaohsiung, Taiwan

Abstract. Muscle hypertrophy is a rare finding in neurologic lesions. Infiltration, stretching, and exercise of the muscle are causative factors of enlargement and hypertrophy. We report a case of unilateral calf hypertrophy postpoliomyelitis. The resection of the total medial and partial lateral gastrocnemius muscle was performed to achieve left calf reduction and a symmetrical contour of both legs. The patient is satisfied with the results and has not complained of any instability in walking or running after 2 years of follow-up.

Key words: Gastrocnemius—Leg contour

Muscle atrophy is the phenomenon usually associated with neurogenic lesions. Muscle hypertrophy is rare but has been reported in cases of peripheral nerve lesions [1], chronic spinal atrophy [2], chronic recurrent polyneuropathy [3], and poliomyelitis [4]. Poliomyelitis has been considered a self-terminating disease. That is, recovery from the resulting paralysis is generally good and most patients assume fully active, normal lifestyles.

Resection of the hypertrophic muscle seems to be an effective method of achieving a visible reduction of the calves. Several studies on leg function after muscle flap transfer have revealed significant impairment after soleus transfer but not after total gastrocnemius transfer [5–7]. Because the gastrocnemius has no single, but only a contributory function to other muscles, the neighboring muscles take over its function easily.

Correspondence to Chih-Cheng Tsai, M.D., Division of Plastic and Reconstructive Surgery, Chung-Ho Memorial Hospital, Kaohsiung Medical University, 100 Shih-Chuan 1st Road, Kaohsiung 807, Taiwan; Fax: 886-7-3111482; e-mail: ipras2@cc.kmu.edu.tw

In this paper, we report on the nearly total excision of the gastrocnemius muscle in a patient with unilateral poliomyelitis calf hypertrophy.

Case Report

A 37-year-old woman was admitted to Kaohsiung Medical University Hospital because of left calf enlargement. She had a medical history of childhood poliomyelitis, which had affected her left leg. The patient was told by her mother that she had contracted poliomyelitis at 4.5 years of age, and a subsequent EMG confirmed the diagnosis. She noted that her left calf had always been large and had never shown atrophy (Fig. 1A). She indicated that as a child she performed daily stretching and strengthening exercises for her left leg. No other pertinent medical history was given. Physical examination revealed excellent general health. There was full range of joint motion in the lower extremities to flexion, extension, and lateral and medial rotation. Motor examination revealed 5/5 strength in the lower extremities. Sensory examination of the lower extremities was normal. The gait was normal in walking and running. The measurements of the hypertrophied calf had remained unchanged since the age of 22. The superior, middle, and inferior level circumferences of the leg were 38, 32.5, and 22 cm on the left leg and 33, 29, and 22 cm on the right leg, respectively. Both thighs were the same size. The patient was transferred to the neurology department for needle electrode EMG examination, and the results were consistent with the diagnosis of old poliomyelitis. No special management for her old poliomyelitis was suggested by the neurologist.

The patient was admitted to our wards for aesthetic contouring surgery of her left hypertrophic calf. She was informed preoperatively about the degree of the reduc-

Fig. 1. (A) Posterior aspects of the patient's legs; note the left calf hypertrophy. **(B)** Patient's status 2 years after resection of the left gastrocnemius muscle.

tion in her left calf and wound hematoma, seroma, and infection. The operation was performed in April 1999.

This patient was placed in a prone position under spinal anesthesia. A horizontal incision 4 cm in length was made at the popliteal area. The medial sural nerve and short saphenous vein were easily preserved when progressing with the incision in the plane between the superficial fascia and the gastrocnemius muscle. Blunt dissection by the finger and dissector in this muscle plane from above and below separated the gastrocnemius muscle from the crural fascia and the soleus muscle. After the gastrocnemius muscle was completely separated, the insertion of the gastrocnemius muscle into the Achilles tendon was sharply cut under the endoscope. A raphe between the medial and the lateral gastrocnemius muscles was easily incised by using an endoscope through the incision wound. The muscle belly was pulled upward, the neurovascular pedicles were identified and ligated, then both heads of the gastrocnemius were cut at their origins. The crural fascia of the incision wound was then closed with 4-0 vicryl. A drainage tube was not necessary. The weight of the resected muscle was 280 g. The resected calf muscle was biopsied and showed striking hypertrophy of type I and, especially, type II muscle fibers, with no increase in fat or connective tissue. The leg was maintained in a raised position postoperatively. Use of an elastic garment was initiated on the second postoperative day after removal of the elastic bandage. This elastic stocking provided comfort during the first month postoperative period. The patient started to walk in high-heeled shoes and was discharged on the second postoperative day. She changed the dressing of the popiteal incision every day by herself. The stitches were removed on the seventh day after the operation. She was regularly followed up at our OPD and did not complain of any instability or limitation in walking or running. Walking on the forefoot or bending of the knee joint was unaffected. After 2 years of follow-up, no complications were noted and the circumferences of the superior, middle, and inferior levels were 33.5, 29.5, and 22 cm, respectively. The hypertrophic left calf had adequate reduction and symmetry with the right calf (Fig. 1B).

Discussion

There are no pathognomonic indicators of prior polio. Sensation is intact, motor control is precise, and reflexes are not exaggerated. Atrophy, an expected sign of flaccid paralysis, is not apparent in most patients. The reason for this lack of atrophy in the presence of muscle paresis has recently been identified. Muscle bulk has been preserved through the addition of sarcomeres (contracting units) to the ends of muscle fibers that are repeatedly exposed to vigorous eccentric demand. A muscle enlargement after poliomyelitis may result from an increase in the size or number of fibers (true hypertrophy) or from infiltration of the muscle by fat, collagen, inflammatory cells, or tumor (pseudohypertrophy). Bertorini and Igarashi showed a thigh muscle pseudohypertrophy postpoliomyelitis by computerized tomography and biopsy [4]. Bernat and Ochoa described true muscle hypertrophy of the calf in a case of S_1 radiculopathy confirmed by computerized tomography [8]. Many authors concluded that partial denervation may predispose to enlargement when some innervated fibers are overworked and/or some innervated or denervated fibers are stretched [9,10]. A possible explanation for this facilitation is that the work performed by the partially denervated muscle produced greater hypertrophy in the remaining innervated muscle fibers because there were fewer of them to perform the work than in the unaffected leg [8–10]. In our patient,

muscle biopsy demonstrated abundant hypertrophic fibers of both types, but mostly type II. This seems to indicate that, in addition to compensatory work-induced type II muscle fibers hypertrophy, there was an element of (type I) stretch-induced hypertrophy of denervated fibers.

We have provided some general criteria that contribute to an aesthetically pleasing leg [11]. First, the maximal circumference is three-fourths of the leg length and is often located on or below the superior level of the four equal parts of the leg. Second, the midleg circumference is equal to 50% of the maximal circumference plus that of the inferior level. Third, the circumference of the inferior level is equal to 63% of the maximal circumference. Many authors [5,12] have reported similar results indicating that resection of partial or both gastrocnemii has no negative effect on the functioning of the legs. In constrast to the resection of the gastrocnemius, the resection of the soleus has been accompanied by a significant 50% reduction of the earlier strength. In our patient, her right leg achieved our aesthetic criteria but the left leg was hypertrophic. We first excised 200 g of the total medial gastrocnemius muscle of the left calf. The circumference of the superior and middle levels was measured intraoperatively and was found to have decreased from 38 to 34 cm and from 32.5 to 29.5 cm. We then excised 80 g of part of the lateral gastrocnemius muscle of the left calf to achieve a smaller size than that of the right calf, because we think that the calf muscle will gradually undergo a certain degree of enlargement after constant use. Two years later, the circumferences of the superior, middle, and inferior levels are 33.5, 29.5, and 22 cm, respectively. This size is close to our goal and the contour is symmetrical with the patient's right leg.

In conclusion, because the leg has become such an important aesthetic characteristic of women in modern times that women with shapeless legs often hide their legs in pants or long skirts, atrophy or enlargement of asymmetrical legs is often a challenge facing the plastic surgeon who wishes to achieve an ideal contour of the leg.

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