P 1-101

Changes in muscle architecture of GCM after nerve block in healthy

Jae Eun Park[1*], Yeon-Jae Seong[2], Eun Sang Kim[2], Dongho Park[1], Yonghyun Lee[1], Dong-wook Rha[1†]

Yonsei University College of Medicine, Department and Research Institute of Rehabilitation Medicine[1], Hafis Clinic, Department of Rehabilitation Medicine[2]

Objective
Muscle architecture is an important determinant of muscle function. Muscle atrophy occurs due to denervation in persons with central or peripheral nerve injuries. Architectural changes of healthy muscle without any comorbid disease after denervation have not been reported so far. Therefore, this study aimed to investigate the architectural changes in gastrocnemius muscles after anesthetic tibial nerve block in healthy adults using ultrasonography (US).

Subjects
Total 19 healthy adults scheduled to undergo tibial nerve branch block to the medial head of gastrocnemius (GCM) for anesthetic calf reduction were recruited in our study. (2 males and 17 females) Subjects were excluded if they had the previous history of (a) CNS disease, (b) neuromuscular disease or (c) any surgical procedures at examined extremities (including procedure such as botulinum toxin injection, liposuction, etc.)

Method
Effect of the tibial nerve block was verified by visual observation and surface EMG analysis. US images of medial GCMs were taken by one trained physician using B-mode and real-time ultrasonography (Accuvix V10c system; Samsung Medison Co., Seoul, South Korea) with a linear-array probe (5 to 12 MHz) before nerve block, at 1wks after nerve block and at 3 months after nerve block in anatomic standing position with the feet about shoulder-width apart. Muscle thickness is a measurement of the longest distance between the fascia of the GCMs in a cross-sectional US image. Muscle fascicle length was defined as the straight-line distance between the upper muscular fascia and the lower muscular fascia parallel to the lines of the collagenous tissue visible on the image. The pennation angle was defined as the angle made between the upper fascia and the direction of the muscle fascicles.

Results
The mean age of the subjects was 28.68 ± 7.99 years. The mean body weight was 57.31 ± 7.07 kg and mean height was 162.44 ± 5.04 cm. The muscle thickness of the medial GCM was significantly reduced in both left and right sides at 3 months after the tibial nerve block ($p<0.05$). Although the fascicle length of the medial GCM was not significantly changed, the pennation angle of the medial GCM was significantly reduced in left side at 1week and at 3 months after the tibial nerve block and in right side at 3 months after the tibial nerve block ($p<0.05$).

Conclusion

To the best of our knowledge, this is the first report of architectural changes in healthy GCM muscle after denervation induced by tibial nerve block. Muscle thickness and the pennation angle of the muscle fascicle of the medial head of GCM were significantly reduced although fascicle length was not significantly changed.

Table 1. Changes in Sonographic parameters of muscle architecture

		Time 1 (baseline)	Time 2 (1 week)	Time 3 (12 weeks)
Left				
	Thickness(cm)	2.23±0.24(1.73-2.53)	2.12± 0.27(1.64-2.58) *	1.69±0.27(1.29-2.23) *
	Fascicle length(cm)	6.64±1.06(4.83-9.34)	6.92±0.99(5.50-8.85)	6.60±1.04(5.13-8.34)
	Pennation angle(degree)	20.11±2.82(15.30-27.40)	18.55±3.30(13.6-25.50)	15.08±2.78(10.60-21.00)*
Right				
	Thickness(cm)	2.24±0.22(1.71-2.65)	2.17±0.30(1.53-2.60)	1.70±0.29(1.07-2.29) *
	Fascicle length(cm)	6.86±0.87(5.19-8.36)	6.89±0.82(5.91-8.71)	6.55±0.85(5.28-8.06)
	Pennation angle(degree)	19.37±2.43(16.50-25.20)	18.75±3.06(12.90-24.50)	14.98±2.51(10.20-18.10)*

Values are expressed as mean ± standard deviation (range).
* p<0.05 compared to Time 1 in linear mixed model

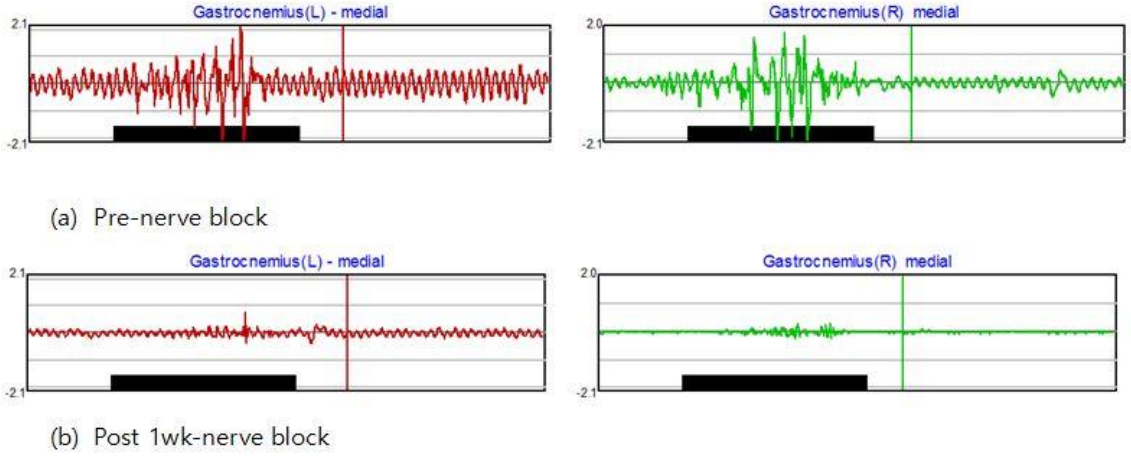

Fig 1. Surface EMG during walking in one subject. (a) pre- nerve block (b) Post 1wk-nerve block

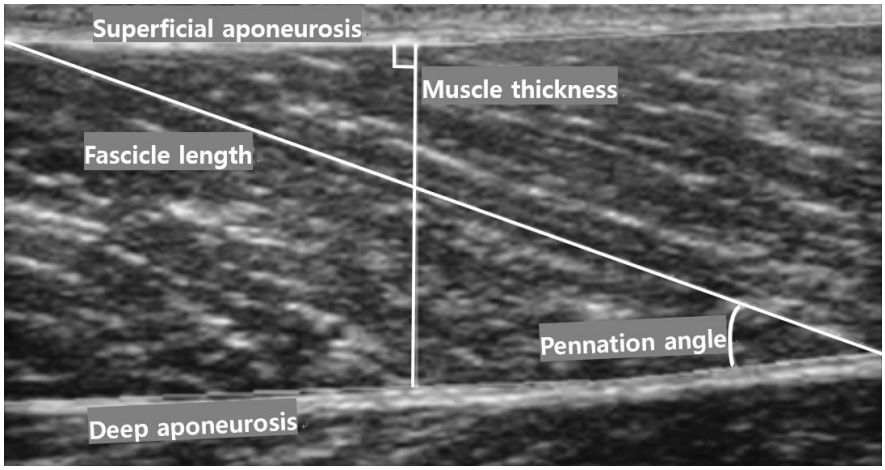

Fig 2. Ultrasound image showing muscle architecture parameters measured.