Anatomical Study and Tridimensional Model of the Crural Fascia

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BACKGROUND
The aim of the study is to describe the structural conformation of the muscular fascia of the leg (crural fascia).

METHODS
The investigation was performed on 5 unembalmed inferior limbs (2 males, 3 females; mean age 67.8 years). For each leg, different samples were taken for the histological (HE, van Gieson and azan-Mallory stains) and immunohistochemical (anti S-100 stain) examination and a morphometric analysis was also performed. From 2 samples, seriated 7-µm thick sections were obtained for the creation of the tridimensional model. All preparations were observed with a Leica DM4500 B.

RESULTS
The crural fascia had a mean thickness of 924 µm and was usually composed of two or three layers (mean thickness 277.6 µm) of collagen fiber bundles, each layer being separated by a thin layer of loose connective tissue (mean thickness 43 µm). In each layer, the collagen fiber bundles had a parallel disposition in one direction, and the orientation changed from layer to layer. On analysis with the *Voxel Counter of ImageJ* any two adjacent directions have a comparable volume fraction of almost 8%, while remaining tissue components are predominant with a volume fraction of almost 80%. The angle between the fibres' orientations was also evaluated in the xy plane using the Angle Tool of ImageJ, resulting in a mean value of 78 degrees. The van Gieson elastic fibers stain highlighted a very scarce presence of elastic fibers. Finally, a computerized tridimensional model of the deep fascia was created.

CONCLUSIONS
Since the spatial orientation of the collagen fibers differs from layer to layer, the crural fascia assumes anisotropic characteristics. In particular, the mechanical response of a single layer differs if the layer is loaded along the direction of the collagen fibers or along another direction. The presence of loose connective tissue interposed between adjacent layers permits local sliding, allowing the single layers to respond more effectively to different traction. If this interlayer sliding is altered by trauma or overuse syndromes then all of the force distribution within the fascia changes.