Microscopic anatomy of the visceral fasciae.

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Author information

Abstract

The term 'visceral fascia' is a general term used to describe the fascia lying immediately beneath the mesothelium of the serosa, together with that immediately surrounding the viscera, but there are many types of visceral fasciae. The aim of this paper was to identify the features they have in common and their specialisations. The visceral fascia of the abdomen (corresponding to the connective tissue lying immediately beneath the mesothelium

Mesothelium
The mesothelium is a membrane composed of simple squamous epithelium that forms the lining of several body cavities: the pleura, peritoneum, mediastinum and pericardium. Mesothelial tissue also surrounds the male internal reproductive organs and covers the internal reproductive organs of women. Mesothelium that covers the internal organs is called visceral mesothelium, while the layer that covers the body walls is called the parietal mesothelium. Mesothelium is the epithelial component of serosa.

of the parietal peritoneum), thorax (corresponding to the connective tissue lying immediately beneath the mesothelium of the parietal pleura), lung (corresponding to the connective tissue under the mesothelium of the visceral pleura), liver (corresponding to the connective tissue under the mesothelium of the visceral peritoneum), kidney (corresponding to the Gerota fascia), the oesophagus (corresponding to its adventitia) and heart (corresponding to the fibrous layer of the pericardial sac) from eight fresh cadavers were sampled and analysed with histological and immunohistochemical stains to evaluate collagen and elastic components and innervation. Although the visceral fasciae make up a well-defined layer of connective tissue, the thickness, percentage of elastic fibres and innervation vary among the different viscera. In particular, the fascia of the lung has a mean thickness of 134 µm (± 21), that of heart 792 µm (± 132), oesophagus 105 µm (± 10), liver 131 µm (± 18), Gerota fascia 1009 µm (± 105) and the visceral fascia of the abdomen 987 µm (± 90). The greatest number of elastic fibres (9.79%) was found in the adventitia of the oesophagus. The connective layers lying immediately outside the mesothelium of the pleura and peritoneum also have many elastic fibres (4.98% and 4.52%, respectively), whereas the pericardium and Gerota fascia have few (0.27% and 1.38%). In the pleura, peritoneum and adventitia of the oesophagus, elastic fibres form a well-defined layer, corresponding to the elastic lamina, while in the other cases they are thinner and

scattered in the connective tissue. Collagen fibres also show precise spatial organisation, being arranged in several layers. In each layer, all the fibrous bundles are parallel with each other, but change direction among layers. Loose connective tissue rich in elastic fibres is found between contiguous fibrous layers. Unmyelinated nerve fibres were found in all samples, but myelinated fibres were only found in some fasciae, such as those of the liver and heart, and the visceral fascia of the abdomen. According to these findings, we propose distinguishing the visceral fasciae into two large groups. The first group includes all the fasciae closely related to the individual organ and giving shape to it, supporting the parenchyma; these are thin, elastic and very well innervated. The second group comprises all the fibrous sheets forming the compartments for the organs and also connecting the internal organs to the musculoskeletal system. These fasciae are thick, less elastic and less innervated, but they contain larger and myelinated nerves. We propose to call the first type of fasciae 'investing fasciae', and the second type 'insertional fasciae'.

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The Lumbodorsal Fascia as a Potential Source of Low Back Pain: A Narrative Review.

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Abstract

The lumbodorsal fascia (LF) has been proposed to represent a possible source of idiopathic low back pain. In fact, histological studies have demonstrated the presence of nociceptive free nerve endings within the LF, which, furthermore, appear to exhibit morphological changes in patients with chronic low back pain. However, it is unclear how these characteristics relate to the aetiology of the pain. In vivo elicitation of back pain via experimental stimulation of the LF suggests that dorsal horn neurons react by increasing their excitability. Such sensitization of fascia-related dorsal horn neurons, in turn, could be related to microinjuries and/or inflammation in the LF. Despite available data point towards a significant role of the LF in low back pain, further studies are needed to better understand the involved neurophysiological dynamics.

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Hormone receptor expression in human fascial tissue.

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Abstract

Many epidemiologic, clinical, and experimental findings point to sex differences in myofascial pain in view of the fact that adult women tend to have more myofascial problems with respect to men. It is possible that one of the stimuli to sensitization of fascial nociceptors could come from hormonal factors such as estrogen and relaxin, that are involved in extracellular matrix and collagen remodeling and thus contribute to functions of myofascial tissue. Immunohistochemical and molecular investigations (real-time PCR analysis) of relaxin receptor 1 (RXFP1) and estrogen receptor-alpha (ERα) localization were carried out on sample of human fascia collected from 8 volunteers patients during orthopedic surgery (all females, between 42 and 70 yrs, divided into pre- and post-menopausal groups), and in fibroblasts isolated from deep fascia, to examine both protein and RNA expression levels. *We can assume that the two sex hormone receptors analyzed are expressed in all the human fascial districts examined and in fascial fibroblasts culture cells,* to a lesser degree in the post-menopausal with respect to the pre-menopausal women. Hormone receptor expression was concentrated in the fibroblasts, and RXFP1 was also evident in blood vessels and nerves. Our results are the first demonstrating that the fibroblasts located within different districts of the muscular fasciae express sex hormone receptors and can help to explain the link between hormonal factors and myofascial pain. It is known, in fact, that estrogen and relaxin play a key role in extracellular matrix remodeling by inhibiting fibrosis and inflammatory activities, both important factors affecting fascial stiffness and sensitization of fascial nociceptors.

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Expression of the endocannabinoid receptors in human fascial tissue.

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Abstract

Cannabinoid receptors have been localized in the central and peripheral nervous system as well as on cells of the immune system, but recent studies on animal tissue gave evidence for the presence of cannabinoid receptors in different types of tissues. Their presence was supposed also in myofascial tissue, suggesting that the endocannabinoid system may help resolve myofascial trigger points and relieve symptoms of fibromyalgia. However, until now the expression of CB1 (cannabinoid receptor 1) and CB2 (cannabinoid receptor 2) in fasciae has not yet been established. Small samples of fascia were collected from volunteers patients during orthopedic surgery. For each sample were done a cell isolation, immunohistochemical investigation (CB1 and CB2 antibodies) and real time RT-PCR to detect

the expression of CB1 and CB2. Both cannabinoid receptors are expressed in human fascia and in human fascial fibroblasts culture cells, although to a lesser extent than the control gene. We can assume that the expression of mRNA and protein of CB1 and CB2 receptors in fascial tissue are concentrated into the fibroblasts. This is the first demonstration that the fibroblasts of the muscular fasciae express CB1 and CB2. The presence of these receptors could help to provide a description of cannabinoid receptors distribution and to better explain the role of fasciae as pain generator and the efficacy of some fascial treatments. Indeed the endocannabinoid receptors of fascial fibroblasts can contribute to modulate the fascial fibrosis and inflammation.

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The role of fasciae in Civinini-Morton's syndrome.

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Abstract

This study evaluates the pathogenetic role of the perineural connective tissue and foot fasciae in Civinini-Morton's neuroma. Eleven feet (seven male, four female; mean age: 70.9 years) were dissected to analyse the anatomy of inter-metatarsal space, particularly the dorsal and plantar fasciae and metatarsal transverse ligament (DMTL). The macrosections were prepared for microscopic analysis. Ten Civinini-Morton neuromas obtained from surgery were also analysed. Magnetic resonance images (MRIs) from 40 patients and 29 controls were compared. Dissections showed that the width of the inter-metatarsal space is established by two fibrous structures: the dorsal foot fascia and the DMTL, which, together, connect the metatarsal bones and resist their splaying. Interosseous muscles spread out into the dorsal fascia of the foot, defining its basal tension. The common digital plantar nerve (CDPN) is encased in concentric layers of fibrous and loose connective tissue, continuous with the vascular sheath and deep foot fascia. Outside this sheath, fibroelastic septa, from DMTL to plantar fascia, and little fat lobules are present, further protecting the nerve against compressive stress. The MRI study revealed high inter-individual variability in the forefoot structures, although only the thickness of the dorsal fascia represented a statistically significant difference between cases and controls. It was hypothesized that alterations in foot support and altered biomechanics act on the interosseous muscles, increasing the stiffness of the dorsal fascia, particularly at the points where these muscles are inserted. Chronic rigidity of this fascia increases the stiffness of the inter-metatarsal space, leading to entrapment of the CDPN.

Fascial Disorders: Implications for Treatment.

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Abstract

In the past 15 years, multiple articles have appeared that target fascia as an important component of treatment in the field of physical medicine and rehabilitation. To better understand the possible actions of fascial treatments, there is a need to clarify the definition of fascia and how it interacts with various other structures: muscles, nerves, vessels, organs. Fascia is a tissue that occurs throughout the body. However, different kinds of fascia exist. In this narrative review, we demonstrate that symptoms related to dysfunction of the lymphatic system, superficial vein system, and thermoregulation are closely related to dysfunction involving superficial fascia. Dysfunction involving alterations in mechanical coordination, proprioception, balance, myofascial pain, and cramps are more related to deep fascia and the epimysium. Superficial fascia is obviously more superficial than the other types and contains more elastic tissue. Consequently, effective treatment can probably be achieved with light massage or with treatment modalities that use large surfaces that spread the friction in the first layers of the subcutis. The deep fasciae and the epymisium require treatment that generates enough pressure to reach the surface of muscles. For this reason, the use of small surface tools and manual deep friction with the knuckles or elbows are indicated. Due to different anatomical locations and to the qualities of the fascial tissue, it is important to recognize that different modalities of approach have to be taken into consideration when considering treatment options.

31.
Investigation of the mechanical properties of the human crural fascia and their possible clinical implications.
Stecco C, Pavan P, Pachera P, De Caro R, Natali A.
Surg Radiol Anat. 2014 Jan;36(1):25-32. doi: 10.1007/s00276-013-1152-y. Epub 2013 Jun 21.

Cranio. 2012 Apr;30(2):95-102.

Myofascial pain of the jaw muscles: comparison of short-term effectiveness of botulinum toxin injections and fascial manipulation technique.

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Abstract

A randomized controlled trial was performed to compare the short-term effectiveness of botulinum toxin injections and physiatric treatment provided by means of Fascial

Manipulation techniques in the management of myofascial pain of jaw muscles. Thirty patients with a Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) diagnosis of myofascial pain were randomized to receive either single-session botulinum toxin injections (Group A) or multiple-session Fascial Manipulation (Group B). Maximum pain levels (VAS ratings) and jaw range of motion in millimeters (maximum mouth opening, protrusion, right and left laterotrusion) were assessed at baseline, at the end of treatment, and at a three-month follow-up. Both treatment protocols provided significant improvement over time for pain symptoms. The two treatments seem to be almost equally effective, Fascial Manipulation being slightly superior to reduce subjective pain perception, and botulinum toxin injections being slightly superior to increase jaw range of motion. Differences between the two treatment protocols as to changes in the outcome parameters at the three-months follow-up were not relevant clinically. Findings from the present investigation are in line with literature data supporting the effectiveness of a wide spectrum of conservative treatment approaches to myofascial pain of the jaw muscles. Future studies on larger samples over a longer follow-up span are needed on the way to identify tailored treatment strategies