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Muscle Cramps

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Introduction

Muscle cramps result in continuous, involuntary, painful, and localized contraction of an entire muscle group, individual single muscle, or select muscle fibers. Generally, the cramp can last from minutes to a few seconds for idiopathic or known causes with healthy subjects or in the presence of diseases. Palpating the muscle area of the cramp will present a knot.

Exercise-associated muscle cramps are the most frequent condition requiring medical/therapeutic intervention during sports [1][2]. The specific etiology is not well understood and possible causes depend on the physiological or pathological situation in which the cramps appear. It is important to note that a painful contraction that is limited to a specific area does not mean that the cause of the onset of the cramp is necessarily local.

A cramp is almost never a local effect but involves the whole body system: somatic and emotional.

Etiology

The etiology of the cramp depends on the situation in which it occurs. It is not possible to draw up the causes, and the possible physiological or pathological differences in which the cramp occurs must be highlighted, as different scenarios give rise to cramps.

Heat-associated muscle cramping is often seen during sports and rigorous exercise or physical activity. In this situation, large losses of sweat and electrolytes are believed to be the underlying pathologic mechanism [3].

Epidemiology

The literature does not clearly explain the epidemiology of cramps, as these muscular phenomena may appear differently depending on the context examined. Furthermore, there is no single text that takes into account the percentage of the cramps, without looking for different pathologies, the sports environment (hot or cold), the type of sport. [4][5][6] Examining the epidemiology of cramps is not a main goal of the researcher. Following are some examples:

- The age of elderly people in France affected by cramps is around 65 to 69 years old.
- There is no relationship between sex and cramps. About 80% of the affected muscle area is the calf.
- Nocturnal leg cramps affect about 6% of the American population, whose condition seems related to heart problems and depression.
- The prevalence of cramps in pregnant women in China affects the calf area, with a percentage of 32.9%. During the first trimester, the response is 11.6%, second trimester, 28.2%, and last trimester, 50.2%. Pregnant Indian women experience the most third-trimester muscle cramps, especially in the calf (64.6%).[7][8]

- A multi-center American study reported that patients with COPD suffer from 46% of muscle cramps, which appears to be the major cause of pain in this patient population.
- Another multi-center American study found that 74% of cramps occur in athletes and in high environmental heat conditions.
- In Australia, 32% of children with Charcot-Marie-Tooth disease type 1A suffer from calf cramps. The phenomenon increases with increasing age.[9]

Pathophysiology

The pathophysiology of muscle cramps is not always clear and depends on the patient's pathological condition. To give an example, in healthy and sporting subjects there is no direct relationship between the depletion of fluids and the alteration of electrolyte balance as a definite cause of cramps.

Despite the depletion of electrolytes during treatment in patients with dialysis, there is no direct relationship between the presence of cramps and dialysis. Despite this, the phenomenon of cramps is very common in this population of patients.[1]

Histopathology

No biopsy studies evaluate the morphology and structure of the muscles of athletes in case of cramps. Many studies evaluate the muscle cell in multiple diseases, where the specific conditions of the disease are described. It is not possible to state that the muscle subject of cramps has specific particularities when compared to the same alterations of the muscle fibers in the presence of pathology.

History and Physical

Cramps have always existed in human history. The literature does not report the exact moment in which the first cramp phenomenon is described in medicine, distinguishing it from a benign event with respect to a symptomatological event.

For a patient examination, in addition to the medical history, the patient's posture must be observed, both in an upright position and during walking. It is necessary to understand if muscular imbalances are present. The muscles must be palpated to make sure that the tissue is homogeneous on both body sides.

The patient is asked to stimulate the muscle area where cramps usually appear (voluntary contraction) for the practitioner to understand whether repeated mechanical active stress causes the cramp. It should also carry out a passive stretching of the muscle to verify if the cramp appears in the absence of active stress by the patient. A cramp caused by a passive stretch could be related to a symptom and not to a benign event.

Evaluation

The palpation is the first evaluation: under the hand feels like a strong tension, which can involve the entire muscular district or a localized node.

Electromyography is another evaluation that can be carried out to understand the type of discharge of the motor units and diagnose a neurological pathology from events that do not concern the disease. The echocardiograph can evaluate morphological anomalies that could trigger the cramp phenomenon.[10][11]

Treatment / Management

The easiest conservative treatment healthy subjects and patients are stretching the involved muscle or deep massages.[12][13][14]

Prevention in healthy subjects could involve correct heating before physical activity and adequate hydration. For the different pathologies also characterized by the appearance of cramps, there are no accepted guidelines as valid on the pharmacological approach in any pathological state.[15]

Differential Diagnosis

A cramp is a painful contraction of short duration and can be distinguished from other muscle contractions. Dystonia is a non-painful contraction of central origin, and myotonia is a protracted non-painful contraction as in the case of myotonic dystrophy and dystrophy of Thomsen. Tetany can be painful but seldom involves only one muscle area, like Camurati-Engelmann disease, anorexia nervosa (Russell sign), or in case of hypocalcemia. Myalgias are muscular pains not necessarily accompanied by contraction for several reasons, such as vitamin D hypovitaminosis, drug abuse, or spastic hypertonia following central nervous lesions. Muscle pain in the lower limbs during walking or intermittent claudication is a symptom of peripheral vascular stenosis. In these cases, the cramp could appear if the patient continues to walk. The syndrome of the legs without rest are involuntary contractions of the lower limbs which do not cause cramps, but only soreness and muscular tiredness when the contractile activity ceases. Similar contractions also could be symptoms of Parkinsonism.

A cramp is not a trigger point. The latter can be acute or latent and described in different modes. According to recent research, a referred pain of a small area and a hypersensitive spot can be defined as a taut band. Another important factor is that the trigger point does not necessarily create pain; it can give local or extended sensory disturbances, tingling, a burning sensation, and a dull ache.

For a further differential diagnosis between a cramp of a physiological condition and a cramp in the presence of pathology, the simplest examination is electromyography. More detailed tests such as magnetic resonance imaging or CT scan can identify any neurological lesions.

Another observational evaluation to understand if a cramp is benign is if the localized musculature developed a morphological anomaly: hypertrophy or atrophy. Weakness is another sign that could lead one to suppose that the cramp is a symptom and not an isolated event. If there is a wind phenomenon, further muscle contraction is caused by very light afferents.

When in doubt, blood tests can be performed to look for myoglobinuria, and if there is hyperCKemia (greater than 2 to 3 times standard). The literature emphasizes that muscle biopsy examinations also can be performed to highlight cellular changes, such as atrophy or phenotypic changes.

For the disorder nocturnal leg cramps (NLC) there are seven differential symptoms to compare with other sleep-related diseases: intense pain, a maximum period of 10 minutes of the presence of the cramp, areas located as a calf or foot and with less frequency to the thigh (quadriceps and ischiocrural muscle), soreness that persists after the disappearance of the cramp, alteration of the sleep cycle, and consequent stress.

Prognosis

In healthy subjects, the prognosis for the appearance of cramps is always benign.

Complications

No articles in the literature show adverse events to benign cramps.

Postoperative and Rehabilitation Care

In all metabolic, neurological, and visceral diseases where one of the symptoms is a cramp, in the rehabilitation field it is customary to perform stretching. This is to try to keep the district or the muscular districts softer, preserving physiological length. When a muscle tends to persist in its shortening, the sarcomeres of the most distal fibers tend to disappear, with the increase of fat and connective tissue. In this way, the muscle will be more tense, worsening its

electromyographic spectrum. A muscle in chronic shortening will have electrical disturbances, as the electric efference will struggle to excite the muscle fiber properly.

Consultations

In case of persistent cramps, either at night or after a physical event (sport or daily activity), it is necessary to contact the medical figure for further investigation.

Deterrence and Patient Education

If after careful evaluation, both observational and after instrumental investigations, the possibility of neurological or other symptoms is excluded, it is possible to give suggestions to the patient, such as correcting unsuitable postural attitudes, recommending stretching regularly, and hydrating if work or sport takes place in hot and humid environments.

Pearls and Other Issues

Several pathological conditions present with muscle cramps. The following are some of the more common considerations:

Nocturnal Leg Cramps

Nocturnal leg cramps (NLCs) affects approximately 37% of the population in America over 60 years of age. The syndrome is also known as sleep-related leg cramps. The most affected muscle area is the calf. Night cramps reduce sleep quality and quality of life in patients. The diagnosis is relatively simple: cramps and nighttime leg pains, which can disappear with stretching of the muscles involved. Despite the diagnostic simplicity during the anamnesis, the exact etiology of such events is unknown. Some causes could be activities where the person stands a lot at work or performs great physical effort during the day. Predisposing factors could include electrolyte disturbances or neurological disorders, hormonal and metabolic disorders, and compressions of nerve roots or compressed arterial vessels. Other predisposing factors could be related to the constant consumption of drugs, such as diuretics, beta-blockers, and statins. From an electrophysiological point of view, muscles with cramps have a lower activation threshold. The fact that NLCs mostly affects people over age 60 may indicate that cramps result from neurological causes. With age a person tends to lose medullary neurons, creating a neuromuscular incoordination more in the lower limbs than in the upper limbs. This disorder would appear to be related to the presence of other diseases, such as heart failure, nocturnal apnea, depressive syndrome.

As a conservative treatment, deep massage or stretching are considered valid options. Drug treatment currently has not given adequate answers.[16][17]

Leg Cramps in Pregnant Women

Muscle cramps in women during pregnancy are very common, about 50%; particularly in the last 3 months and during the night.

The exact cause of this disorder is not completely clarified. It could be an alteration of neuromuscular function, excessive weight gain, peripheral nerve compressions, insufficient blood flow to the muscles, and increased work by the muscles of the lower limbs. It could increase the glomerular filtration and the need for the fetus to receive minerals, compared to the muscular need of the mother's legs, with reduction of calcium and magnesium.

Pregnancy cramps are not related to fetal growth problems. There seems to be a relationship between night camps and snoring for some pregnant women. This would lead to problems of fetal growth (delays) and early births.

Currently, there is no adequate treatment to reduce the incidence of cramps.

Exercise-Associated Muscle Cramp

Exercise-Associated Muscle Cramp (EAMC) is an event that frequently occurs during or after physical activity. Currently, two hypotheses exist.

The first is related to the concept of dehydration and electrolyte imbalance, while the second, most recent theory is linked to a transient peripheral neurological disorder. The major findings indicate a peripheral fatigue of neurological origin as a cause for the appearance of cramps. Continuous muscle contractions increase the afferents from the neuromuscular spindles, with parallel inhibitory effect on Golgi tendon organs. Stretching reduces the efferences of the second motoneuron to the muscle with the cramp, improving at the same time the afferences of the Golgi. The first theory of electrolyte alteration and cramping is not reflected in human model research.

Stretching before a physical activity does not prevent the appearance of a probable cramp.

Writer's cramp

Writer's cramp (WC) is a specific dystonia of the hand used for writing; it is found in particular between 30 and 50 years of age. Recent studies demonstrate different abnormalities of the central neural network, both as activity and as altered volume involving some areas of the cortex, the cerebellum, and the basal ganglia. The differences in the results probably depend on the individuality of the subject and the tools used for the research.

Cramp-Fasciculation Syndrome

Cramp-fasciculation syndrome (CFS) is a peripheral syndrome linked to a hyperexcitability of the peripheral nervous system. This situation leads to the presence of unwanted muscle cramps and/or fasciculations. In some subjects, other symptoms may appear, such as numbness and burning sensation, that are typical of a neuropathy. Antibodies often are found in these patients to the detriment of potassium channels, with a prevalence of male sex. We do not have adequate explanations or treatment for this condition.

End-Stage Renal Disease

People with chronic renal failure undergoing dialysis often suffer from muscle cramps, up to 50%, especially involving the lower limbs. The advent of cramps can happen during dialysis or at home. The cramps in this type of patient are linked to depression, a decline in quality of life, and sleep disorders. The etiology of cramps in hemodialysis patients is not clear.

One possible cause is the presence of polyneuropathy, typical in these situations, with morphological and functional alterations of the peripheral nerve fibers. Renal transplantation greatly reduces the presence of cramps.

Amyotrophic lateral sclerosis

About 95% of patients with amyotrophic lateral sclerosis (ALS) report cramps. The frequency and intensity of the cramps are not related to the severity of the disease. The causes of these cramps are not well known but probably derived from neuronal hyperexcitability. The drugs that reduce cramps in these patients are mexiletine and quinine sulfate with the latter having serious contraindications.

Cirrhosis

Muscle cramps in this patient population is a usual and high event (88%). With electromyogram, the activation of involuntary potential action of the motor units was rather high, over 150 Hz. The behavior of the peripheral nervous system is not connected to nerve degeneration. The cause that supports the presence of cramps remains inconclusive. The presence of cramps varies depending on the muscle area: cervical (9%), thigh (43%), calf (70%), toe (50%), abdominal muscles (12%), and fingers (74%). More areas of the body can be affected. No direct relationship is established between age or specific causes that lead to cirrhosis (alcohol, infection, etc.). No connectable cause or specific treatments are known to avoid the onset of cramps in patients with cirrhosis.

Anti-Myelin-Associated Glycoprotein Antibody (Anti-MAG) Neuropathy

About 60% of patients have the phenomenon of cramps, particularly affecting the lower limbs and upper limbs (only 20%). Most events happen at night or during exercise. There is not a valid explanation as in this pathology due to the presence of cramps, and there is no therapeutic strategy to limit the phenomenon.

Diabetes

In people with diabetes, the onset of cramps is connected with the presence of neuropathy, with a hyperexcitability of the peripheral nerve. Type I diabetes has a lower percentage of cramps (around 60%) compared to type II diabetes (about 80%). In type II diabetes, nephropathy is another factor for cramps. Another probable cause of cramps is related to the alteration of peripheral vascularization, creating episodes of ischemia and cramps.

Fibromyalgia

According to the National Data Bank for Rheumatic Diseases, the onset of cramps is among the ten co-morbidities affecting patients. One of the most likely causes is the hyperexcitation of the peripheral nervous system. According to recent research, the presence of cramps and peripheral neurological alteration has a direct relationship with the severity of the disease and an inverse relationship with the quality of life.

Enhancing Healthcare Team Outcomes

Muscle cramps are not life-threatening but they may be indicative of a wide range of systemic disorders. Thus, most physicians and other healthcare providers need to be aware of the different causes and management. In addition, the pharmacist should be fully aware that there are many medications that can induce muscle cramps. In many cases, managing the primary cause can lead to the resolution of the muscle cramp. The majority of muscle cramps subside on their own and hence medical treatment is unnecessary. Patients with ongoing muscle cramps need to be referred to the relevant specialist to determine the cause and management. However, the patient should be informed that despite the availability of a vast number of medications, their efficacy is low and unpredictable.[18][14][17] (Level V)

Outcomes

Muscle cramps in most people resolve on their own and medical treatment is unnecessary. Because of the spontaneous resolution, it has been difficult to determine the real effectiveness of medications. To date, the majority of medications used to treat muscle cramps have low efficacy and even their therapeutic action is unreliable or unpredictable. What works in one person may not work in another person. As far as quinine is concerned, studies indicate that the drug may not be effective at all. And the drug is also associated with a number of disturbing adverse effects. At present, quinine should not be considered as the first or even the second drug of choice for muscle cramps. [19][20](Level V)

Questions

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