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Issue 3 | Issue 2 | Sup 1 | Iss

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Article

Postmarketing studies program to assess the risks and benefits of long-term use of extended-release/long-acting opioids among chronic pain patients

Paul M. Coplan, M. Soledad Cepeda, Kenneth R. Petronis, Angela DeVeaugh-Geiss, Alexandra I. Barsdorf, David M. Kern & Richard Fanelli

Pages: 44-51

Published online: 13 Nov 2019

Article

Pain as a determinant of health-related quality of life in patients with carpal tunnel syndrome; a case-controlled study

Nicolas Anthony Damms, Lucy Moira McCallum, Ptolemaios Georgios Sarrigiannis & Panagiotis Zis

Pages: 52-55

Published online: 30 Nov 2019

Postgraduate Medicine

Pages: 56-61

Published online: 12 Nov 2019

Article

Are postoperative pain and patient satisfaction influenced by the number of ports in VATS for malignant pleural effusion treatment?

D. Valchev, K. Peeva & D. Petrov

Pages: 62-65

Published online: 24 Jan 2020

Clinical Features - *Review*

Review Article

The current role of Astym therapy in the treatment of musculoskeletal disorders

E. Carlos Rodriguez-Merchan, Hortensia De La Corte-Rodriguez & Juan M. Roman-Belmonte

Pages: 66-71

Published online: 28 Aug 2019

Postgraduate Medicine

Review Article

New discoveries for an old drug: a review of recent olanzapine research

Amir M Meftah, Elizabeth Deckler, Leslie Citrome & Joshua T Kantrowitz

Pages: 80-90

Published online: 03 Jan 2020

Clinical Features - *Original Research*

Article

A multi-arm cluster randomized clinical trial of the use of knee kinesiography in the management of osteoarthritis patients in a primary care setting

Alix Cagnin, Manon Choinière, Nathalie J Bureau, Madeleine Durand, Neila Mezghani, Nathaly Gaudreault & Nicola Hagemeister

Pages: 91-101

Published online: 01 Oct 2019

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Meralgia paresthetica: finding an effective cure

Ardo Sanjaya

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CLINICAL FOCUS: PAIN MANAGEMENT
REVIEW

Meralgia paresthetica: finding an effective cure

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ABSTRACT
Meralgia Paresthetica (MP) is one of the most common mononeuropathies of the lower limb. MP usually resolves on its own, even without treatment. However, many physicians are not aware of this diagnosis and may confuse patients with another nerve disease such as radiculopathies. Although no motor symptoms are associated with this condition, the sensory dysfunctions are potentially debilitating to patients. The variable course of the lateral femoral cutaneous nerve also complicates treatments. Thus, the author recommends the use of ultrasonography to help locate the nerve. Many treatments for MP are available, but they are supported only by moderate to low-quality evidence. Treatments range from conservative to interventions using nerve blocks and surgery. Without a clear superiority of any treatment, the author concludes that treatment should be done in a stepwise fashion, from the noninvasive to the more invasive treatment if symptoms persist.

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1. Introduction

Meralgia paraesthetica (MP) is a mononeuropathy of the Lateral Femoral Cutaneous Nerve (LFCN). It is one of the most common mononeuropathies of the lower limb and is associated with many predisposing factors that injure the LFCN along its course from the pelvis toward the thigh. Since the LFCN is a purely sensory nerve, injury to the nerve causes a considerable amount of pain and discomfort without any accompanying motoric dysfunction of the lower limb. MP are commonly encountered in patients with an age group of 41–60 years with an incidence rate of 3–4 patients per 10,000 person-years [1–3]. In association with gender MP is a predominantly male condition, although some were reporting a female predominance [1]

MP is not a new condition, and yet there are very few research and trials evaluating the cause, diagnosis, and treatment of this condition. Also, one study reported that only a handful of MP cases are correctly diagnosed even though the symptoms were typical of MP [4]. MP was first described by the German neuropathologist Martin Bernhardt (1844–1915) in 1878, and in 1885 Hager postulated that LFCN nerve injury is the cause of the pain. However, it was not until 20 years later that a Russian neurologist named Vladimir Karlovich Roth (1848–1916) called the condition meralgia paraesthetica [5–7]. Meralgia paresthetica is derived from the Greek word *meros* for 'thigh' and *algos* for 'pain,' meaning thigh pain [7] literally. Even Sigmund Freud had written an article (in German) explaining his struggle with MP [8]. Although at that time, Freud attributed the conditions to psychosomatic factors [8,9]. One of the common causes of MP is due to compression of the nerve at the inguinal area but there are many case reports that list other less common or often overlooked causes such as following iliac bone graft harvesting, pelvic surgery, appendicectomy, femoral artery catheterization, cesarian section, lumbar neurinoma and spine surgery in the prone position [10–15]. The purpose of this review is to examine the current literature for MP to emphasize its variable anatomy and its correlations to interventions, the many causes and the diagnosis and management of this condition to help physicians diagnose and treat this painful and potentially debilitating condition.

2. The anatomy of the lateral femoral cutaneous nerve

The lateral femoral cutaneous nerve (lateral cutaneous nerve of the thigh) is a nerve that originates from the lumbar plexus, specifically the second and third lumbar segments. The nerve appears at the lateral border of the psoas major and courses obliquely toward the inguinal ligament at the anterior surface of the iliac muscle. At this site, a dense layer of fascia called the iliac fascia covers the nerve [6,16]. As it exits the abdomen, the nerve shows a very variable course with many investigators reporting multiple exiting variants of the LFCN nerve [6,17–20].

In about 85% of the cases, the LFCN exits medial to the Sartorius' muscle but with varying distance from the anterior superior iliac spine (ASIS) [18,19]. The distance between the LFCN to the ASIS range from 0 mm (immediately beside the ASIS) to 40 mm with an average distance of 8 mm [18]. In the rest of the cases, the LFCN follows a very variable course with an investigator reporting a direct association of the abnormal nerve course with MP [21]. These many exit variants necessitate the need for a thorough imaging examination not just for procedures involving

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or in proximity toward the inguinal region but for diagnostic and therapeutic purposes in MP as well.

Aszmann et al. also described multiple types of LFCN exit variants and attributing some variety as more vulnerable in LFCN injuries. They postulated that in patients where the LFCN are located close toward the ASIS, it would predispose them toward MP [6]. Also, a single case-control study found that MP patients had significantly less distance between the LFCN and the ASIS compared to healthy controls [22]. According to currently available evidence, some anatomic position of the LFCN appears to predispose individuals to develop MP.

After the nerve exits the abdominal cavity into the inguinal region, the nerve undergoes a sharp angulation as it transitions into the inguinal region [17,23]. Therefore, the extension of the lower limb on some exit variants of the LFCN creates more tension [23], and on obese patients, the sagging abdomen creates chronic traction and compression on the LFCN further injuring the nerve [17].

3. Etiology and risk factors

The primary pathology of MP is due to injury of the LFCN [23]. This injury may occur along the nerve course from the lumbar vertebrae toward the thigh, but the most common location is when the nerve pierces or travels below the inguinal ligament [7,17]. A small retrospective study investigating patients with MP found that the damage to the LFCN was very similar with animal models of chronic nerve compression and another retrospective study found that patients with MP had LFCN located close to the ASIS, creating an anatomical predisposition for compression [6,22,24]. With the currently available evidence, chronic compression appears to be the primary type of injury in most cases of MP.

The causes of MP may be categorized as spontaneous and iatrogenic [7]. The spontaneous type is MP that is not caused by any surgical procedures. The Iatrogenic type is an MP that may be considered a complication of some surgical procedures (hernia repairs, spine surgery, femoral artery catheterization) [10,12,13,15].

In spontaneous MP, many risk factors are involved. Obesity and compression of the inguinal area by trousers or heavy belts or vests may lead to LFCN compression [3,21,25–28]. Diabetes also appears to be an independent risk factor, with MP occurring seven times more likely in the diabetic populations compared with the general population [3].

One of the most well-known causes of iatrogenic MP is due to a complication of prone position spine surgery. There are many reports on these cases with an incidence rate ranging from 12% to 24%. Although for most patients, this condition was temporary and followed by a complete recovery of the symptoms [29–31]. The reason for MP in these patients was due to compression of the LFCN in the prone position during surgery, with obesity (heavier weight causes more substantial compression) and longer surgery time (more prolonged compression) were associated with an increase in incidence [30]. Even though the condition is self-limited, education is required as the situation may cause distress for the patients.

Other known causes of iatrogenic MP are due to iliac bone graft harvesting. Sensory changes are frequent after iliac bone graft harvesting, although not all are due to MP since iliac bone graft harvesting may injure many local nerves [32]. Some case reports had attributed MP as a complication of bone graft harvesting in this location, albeit a rare one [10,33]. The many variations of the LFCN course as it exits the pelvis may account for the possible damage to this nerve even if the surgeon strictly adheres to the procedures for harvesting.

There are many anecdotal reports on other causes of MP. It ranges from trauma during surgical procedures to the mass effect of tumors. For example, in trauma cases, an investigator had reported a case of MP suspected because of cecum mobilization during a laparoscopic appendectomy operation [11]. Another had reported instances of MP due to catheterization of the femoral artery due to nerve damage or local hematoma compressing the LFCN [12,13], and there are multiple reports of MP due to compression of the LFCN by tumors [34,35]. Fortunately, these and other iatrogenic causes usually have an excellent prognosis with an almost complete recovery of symptoms [30].

4. Clinical symptoms

MP is usually unilateral, although bilateral cases do sometimes happen. The symptoms typically appear on the lateral or the anterolateral aspect of the thigh (on the area supplied by the LFCN nerve) [4]. Numbness is the most common symptoms, but other symptoms include tingling, burning, and pain in the affected area [2,4]. Since the LFCN is a purely sensory nerve, there should not be any motor disturbances. The symptoms may present for an extended period with durations lasting up to thirty years or intermittently with spontaneous resolution of symptoms [2]. Conditions that stretch or compress the LFCN such as prolonged standing or extension of the hip joint during driving and walking may aggravate MP symptoms [2,7]. The clinical manifestations of numbness or paresthesia in the area supplied by the LFCN combined with no motor disturbances should be discriminating enough to separate MP with other types of radiculopathy. Since nerve root diseases usually present with a mix of motor and sensory disturbances.

5. Diagnosis

The diagnosis of MP is straightforward. However, a study found that 61% of cases referred for electrophysiological testing were not diagnosed as MP even though only 27% of cases had an atypical area of sensory changes [4]. Therefore, the treating physician needs to have adequate knowledge and a high index of suspicion to make a correct diagnosis and treatment for this potentially debilitating condition.

Many options are available for treating physician to guide MP diagnosis in atypical or ambiguous cases. The pelvic compression test is a noninvasive test first described by Nouraei et al. for use in MP [36]. To date, there have not been any additional studies designed to evaluate the use of pelvic compression test for diagnosing MP. However, the initial study results showed favorable results with a sensitivity and specificity of 95% and 93.3% [36]. Since this test relies on the assumption that the source of the compression is the inguinal ligament, sources of entrapment other than the inguinal ligament may produce a false negative result (e.g. tumors). Other kinds of adjunct testing that can be used to help diagnose MP include CT Scan, MRI, Ultrasonography, and Electrophysiological testing.

5.1. Ultrasonography

Ultrasonography is mainly used to aid in locating the LFCN, and for this indication, past research had established its usefulness [22]. However, Ultrasound as an adjunct to diagnosis is still not well known. Most literature on ultrasound in MP focus on its value to locate and verify the different nerve course and as a guide for nerve blocks. An article mentioned that the finding of a hypoechoic and or swollen LFCN might be found in MP [37], yet to date, few studies are examining the use of ultrasonography as diagnostic tools. One study concluded that cross-sectional area (CSA) and the maximum diameter of the nerve is a good indicator for diagnosis [38], but with a small sample and variable location of entrapment, it may be challenging to choose a specific position and cutoff. More thorough studies, preferably with bigger sample size, a complete description of the nerve course and a location to measure the LFCN are needed before ultrasonography becomes the mainstay in MP diagnosis. Therefore with the currently available evidence, it would be best only to use ultrasound to aid interventions and to minimize complications involving procedures toward the inguinal area.

5.2. Electrophysiologic tests

Electrophysiological testing may be considered the definitive standard for diagnosing MP. Since MP is a purely sensory nerve, motor nerve conduction studies would be normal in all cases. This finding is essential since a healthy motor nerve rules out nerve root disease and other polyneuropathies [4]. Two types of electrophysiologic tests are available to evaluate MP, somatosensory evoked potential (SEP), and sensory nerve conduction testing.

The somatosensory evoked potential is one of the modalities that can be used to evaluate peripheral sensory nerve. The basic concept of SEP is to record the sequential activation of nerve structures along the somatosensory pathway [39]. Although many studies have reported the potential usefulness of SEP [40,41], one study about SEP conducted by Seror compared the use of SEP with sensory nerve conduction studies and found the opposite. The study reported that although SEP has an advantage of its accessible applications especially in obese patients, it is not reliable for diagnostic testing in MP cases [42], although it is quite specific (76%), its sensitivity is inferior (52%) and would miss a lot of MP cases [42]. However, the ease of use for SEP may be an advantage in obese patients, especially if the nerve is hard to locate for direct stimulation in sensory nerve conduction testing.

In sensory nerve conduction testing, the electrophysiologist measures what is called sensory nerve action potentials (SNAP). During this test, the electrophysiologist stimulates the nerve using a probe, and a recording of the nerve action potential is taken at some point along the nerve course [43,44]. Seror and Seror had found that the side-to-side amplitude ratio (ssRatio) was a better index to diagnose lesions of the LFCN than SNAP. A ssRatio of 2.3 has a specificity of more than 98.75% [4] and should be adequate to confirm MP diagnosis if the clinical pictures are uncertain. Another measure in sensory nerve testing is the SNAP amplitude with a cutoff of < 3 μV. However, it was found positive in only 73.3% of MP patients [4]. Another study conducted by Tataroglu et al. reported that slowed nerve conduction could be a useful tool to help diagnose MP [44].

Nevertheless, more research is needed to elucidate an optimal cutoff point and to examine the sensitivity and specificity of slowed nerve conduction as a diagnostic tool in MP. The problem with electrophysiological testing is that it may be difficult to pinpoint the location of the LFCN due to its different courses. However, this test might help confirm those difficult to diagnose cases, notably to differentiate MP with radicular neuropathies.

5.3. MRI and other imaging tests

In MP cases, imaging tests such as MRI, CT Scan, or X-Ray cannot be used to evaluate the LFCN directly. However, imaging tests are useful to rule out other probable causes of MP. Lumbar disc herniation compressing the lumbar nerve roots or tumors affecting either the root or the LFCN are causes that may be visualized using imaging tests [34,35,45]. Although of limited value in spontaneous MP, imaging tests may be useful to evaluate and rule out less common causes of MP.

6. Treatment

The approaches to treat MP are conservative interventions, using nerve blocks and surgical interventions. The choice of treatment largely depends on the patient needs and response to therapy. A Cochrane review by Khalil et al. has examined the choice of intervention in MP and concluded that there is weak evidence to support an intervention over the other. However, multiple high-quality observational studies have described improvements in treating MP using conservative measures, nerve blocks, and surgical interventions [46].

6.1. Conservative interventions

Conservative interventions include measures to alleviate compression of the LFCN such as removal of the offending heavy belts or vest, changing from a tighter trouser to a looser one, and losing weight [2,25,28]. There have been no clinical trial to date examining the efficacy of conservative treatment for MP, but a small case report from Ecker with a follow-up duration averaging for two years showed that 62% of patients achieved complete resolution of symptoms with the rest making partial or no resolution [2,46].

Other conservative interventions reported in the literature are the use of analgesic or non-steroidal anti-inflammatory drugs [46]. Since most patients with MP reported a complete recovery without the use of invasive interventions (nerve blocks and surgeries) and these measures carry smaller risks, a trial of analgesics, ice pack, NSAIDS combined with additional behavioral interventions to alleviate compression may be beneficial for most patients. If the symptoms persist despite optimizing these conservative approaches, the patient may be offered other therapies after considering their risk and benefit.

6.2. Nerve blocks

Nerve blocks using local anesthetics may be an alternative to surgical interventions when conservative measure fail to achieve adequate symptoms relief. Since there is a very high variability of the LFCN course [6,17–20], USG guidance is recommended to locate the LFCN nerve and to guide needle injection to optimize treatment. Many investigators have reported the efficacy of nerve blocks, although the evidence is conflicting [46]. Promising therapies include mixing corticosteroids with local anesthetics [47–49]. Although the proofs are comprised of small sample studies, the improvement with repeated injections is significant and consistent during the short follow up [47–49].

In this procedure, an ultrasound probe is first used to locate the LFCN. After locating, a needle is advanced through under the visualization of the ultrasound probe. Injection of the mixture of anesthetics would result in a doughnut-shaped nerve due to perineural spreading [48]. Anesthetic combinations that have been used in the studies include methylprednisolone acetate or triamcinolone acetonide combined with mepivacaine or bupivacaine with the varying volume of the substance used [47–50]. However, in general, 10–15 mL of volume should be adequate for LFCN block [51].

6.3. Surgical interventions

Two surgical interventions may be used in MP: Neurolysis and Neurectomy, but both have their advantages. In neurolysis, the surgeon tries to release the nerve from compression along its course. There are some challenges with this approach, most notably the variable course of the nerve and the location of the compression. One of the most common methods is threefold; the first is to sever the inguinal ligament overlying the LFCN, then to cut the iliac fascia underlying the nerve, and last to cut distally along the thigh fascia for each division [52–55]. Success rate following this procedures varies with reports ranging from as low as 60% to as high as 99% [46] with most studies reporting an average of 80% success rate [52–55]. Although the success rate is not very high, this approach carries the main advantages of no sensory loss following the procedures due to preserving the nerve.

Another approach used in MP is neurectomy. Neurectomy refers to procedures to sever the LFCN, therefore, denervating and alleviating the unpleasant sensory symptoms caused in MP. Although the evidence is weak, some studies and a Cochrane review concluded that neurectomy is an effective and sometimes a superior intervention compared to neurolysis with a success rate of 85 – 100% [46,56,57]. However, with this intervention, a new, potentially bothersome symptom arises, numbness. The numbness occurs in the area that was supplied by the LFCN, but one study with a very long follow up period (mean 93 months) showed that most patients were notably not bothered [56]. It is up to the treating physician to consider whether it is more helpful to replace a painful condition with a potentially distressing symptom that may last for a lifetime.

There is inconclusive evidence favoring one surgical intervention over another. Especially since there are multiple ways to release, approach and expose, and sever the LFCN in MP cases. Currently, there is an ongoing RCT to evaluate whether neurolysis or neurectomy is more effective as a treatment for MP, but it has not been completed yet by the time of writing [58]. However, the author concluded that since both are effective, perhaps neurectomy should be reserved for more extreme or refractory cases of MP. In the future, the RCT results will aid decision making on which interventions are more effective than the other.

6.4. Promising treatments

Pulsed radiofrequency (PRF) neuromodulation is an alternative treatment, with low potential risks. During PRF treatment, a needle is advanced to the LFCN, but instead of coagulating the nerve as in the usual Radiofrequency treatment, a current is applied with controlled temperature (42°C). This electrical current supposedly carries therapeutic actions on the nerve without creating pathological lesions [59].

However, the evidence for PRF is minimal; one author even describes that the popularity of pulsed radiofrequency is 'severely disproportionate' to the currently available evidence [59]. A few authors have reported in the efficacy of PRF for MP, but the evidence range from case reports with a single sample, to a retrospective review [60–62]. Therefore, with currently available evidence, this treatment is better reserved for research settings.

7. Conclusion

MP is a mononeuropathy of the LFCN and can affect many people. The incidence of MP is not common and relatively benign. However, the morbidity associated with the pain can last for a very long time. MP may occur without a known cause (idiopathic), or it may occur due to tumors or procedures involving the inguinal area.

The LFCN is a purely sensory nerve which arises from the second and third lumbar segments. LFCN carries no motor functions and damage to the nerve causes impaired and unpleasant sensations in the area supplied by the nerve. The LFCN anatomy is varied with many variations reported in the literature, and some varieties are predisposing individuals to develop MP. For this reason, the author supports the use of ultrasonography to guide interventions in the inguinal area to prevent iatrogenic MP.

MP usually can be diagnosed clinically using symptoms alone. The symptoms of a damaged sensory nerve such as pain, burning, and numbness are typical in the anterolateral thigh area. Although in some cases there may be variations in the LFCN branching pattern and therefore its area of distribution. In those difficult to diagnose cases, physicians may use diagnostical adjuncts to help ascertain the cause.

The pelvic compression test is a bedside physical examination that may be used to diagnose MP. However, since it is used under the assumption that the inguinal ligament is the source of entrapment in MP, there may be false-negative results for MP cases where the cause of entrapment is not the inguinal ligament such as tumors of the abdominal cavity. In those cases, electrophysiological testing is arguably the current gold standard in MP diagnosis.

Electrophysiological testing is a specific test to diagnose MP. In this test, the electrophysiologist measures if there is damage toward the LFCN nerve, which is shown in the amplitude of its action potentials. If the symptomatic areas are atypical, or if there is doubt about the diagnosis of MP, electrophysiological testing will be useful to ascertain if there is damage toward the LFCN.

Treatment for MP is classified into conservative, nerve blocks, or surgical interventions, however current evidence cannot support the use of one treatment over the other. Conservative treatments include the use of analgesics, ice packs, weight reductions, and the use of less constrictive clothing. These intervention carries minimal risks and should be the first line of treatment for MP. If the condition persists despite adequate conservative measures, the physician may move to a more invasive treatment if the benefit outweighs the potential risks involved.

Nerve blocks are a potentially beneficial treatment in MP. However, the evidence is inconclusive. Small case studies have shown that nerve blocks are useful as a treatment for MP, although some cases need repeated injections to provide adequate pain relief. Surgical interventions are arguably very effective in most cases but carry a higher risk. Neurolysis and neurectomy are both adequate treatments with neurectomy achieving an almost complete cure rate. However, neurectomy also creates numbness on the area previously supplied by the LFCN.

To conclude, Meralgia Paresthetica is a mononeuropathy of the lateral femoral cutaneous nerve (LFCN). Diagnosis is straightforward and can be done using clinical signs and symptoms. In dubious cases, many diagnostic adjuncts can be used from electrophysiological testing to MRI and other imaging tests. There is no single most effective treatment for MP with each carrying their risk profile, and it is up to the treating physician to decide which treatment would provide the most benefit for the patient. However, the author supports the use of stepwise treatment from low risk, ascending to higher risk treatment if the result is unsatisfactory.

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