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GENICULAR BLOCK IN THE TREATMENT OF ADVANCED KNEE ARTHROSIS

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Abstract: Osteoarthritis is a chronic degenerative joint disease that is evidenced by the wear and tear of joint cartilage and that often affects weight-bearing joints, such as the knee. This disease tends to affect older people and is characterized by severe pain, joint stiffness and limited mobility. In more advanced cases, the approach to knee osteoarthritis with conventional conservative pharmacological and non-pharmacological treatment may not provide satisfactory results. Genicular nerve block has recently emerged as a new treatment alternative for chronic knee pain. The objectives of the study were to carry out a systematic review of the literature to assess the reduction in pain and the functional improvement of genicular blocks in the treatment of osteoarthritis in the medical literature.
Keywords: Blockade of the geniculate nerves. Illness. Knee. Osteoarthritis. Treatment.

INTRODUCTION

Osteoarthritis (OA) of the knee is a chronic disease that tends to affect the elderly; it is characterized by severe pain, joint stiffness, and limited function (Neogi and Zhang, 2013; de Rooij, 2016; Nazarinasab, 2017). Since the post-industrial era, prevalence in developed countries has greatly increased: increased life expectancy, increased body mass index, and other independent variables are all related to the increase in this prevalence (Wallace, et al. 2017).

Knee pain associated with OA has been shown to be an independent risk factor for premature death. Therefore, alleviating knee joint pain is a global health issue (Cleveland, 2019).

In general, the goals of treatment for osteoarthritis of the knee include improving the patient's function and reducing pain. The initial treatment of OA is non-surgical treatment, that is, conservative treatment, using analgesics and changes in lifestyle, such as weight loss, exercise, physical therapy and even acupuncture (Wannmacher, 2006). included physical therapy, nonsteroidal anti-inflammatory drugs, and intra-articular corticosteroid injections (Brown, 2013).

When conservative treatment fails to achieve these goals, surgical intervention of total knee arthroplasty is a good choice for improving the patient's function and relieving pain (Paxton, et al. 2010; Brown, 2013). Available surgeries include arthroscopic debridement, osteotomies, arthroplasty, and arthrodesis (Moseley, et al. 2002; Richmond, 2008).

As estimated by Weinstein, et al. (2013), 52.2% of men and 50.6% of women were diagnosed with symptomatic knee OA and will undergo total knee arthroplasty during their lifetime.

For many, chronic knee pain can be treated by blocking the pain signals transmitted to the knee via the genicular nerves. This procedure is called Genicular Nerve Block or Neurotomy. The block/ neurotomy ofgenicular nerveIt is a relatively new technique used to treat severe knee joint pain, but it does not respond to other treatments. Normally, there are 3 branches used to block the nerve i.e. the superior medial branch, the superior lateral branch and the medial internal genicular nerves.

The superomedial, superolateral and inferomedial genicular branches can be reached with great accuracy under ultrasound guidance, the branch can be reached accurately by direct visualization or by determining the position using landmarks. Ultrasound-guided genicular nerve block is based on anatomical research results, which show that the genicular nerve is accompanied by arteries and is located close to bone, muscle and tendon structures, which can be better observed and accurate by

ultrasound. Punctures are performed around the knee, close to the site of each nerve to be blocked, to infiltrate the solution with local anesthetic and corticosteroids (Hirasawa, et al. 2000; Yasar, et al. 2015; Kim, et al. 2016; Qudsi -Sinclair, et al. 2017; Kim, et al. 2018; Tran, et al. 2018).

The objectives of the study wereperform a systematic review of the literature to assess the reduction in pain and the functional improvement of genicular blocks in the treatment of osteoarthritisin the medical literature. Addressing the following specific objectives:Present the anatomical changes resulting from arthrosis; Describe the main aspects of osteoarthritis; and Identify the main indications for the treatment of knee osteoarthritis.

DEVELOPMENT

ANATOMICAL MODIFICATIONS

The knee joint is the largest and most complex joint in the human body. It is a synovial joint characterized by a bag lined by a synovial membrane that secretes lubricant, movements occur by sliding between two lubricated surfaces of the hinge type. Convex and concave surfaces cooperate, and movement is limited to flexion and extension in only one plane (Serra, 2001).

Ligaments connect the bones that make up the joint. They provide stability and allow the joint to move. They cannot resist movement, but they can control instability within the joint's maximum range of motion (Thompson and Floyd, 2002).

The anterior cruciate ligament and the posterior cruciate ligament extend from the bone adjacent to the femoral intercondylar notch to the tibia, anterior and posterior to the intercondylar eminence, respectively. The cruciate ligaments are considered intra-articular structures, although they are located outside the synovial capsule, being named according to their insertions relative to the tibia. The medial (tibia) and lateral (fibula) collateral ligaments prevent passive movement of the knee joint in the frontal plane. Second, when the knee joint is stretched, the collateral ligaments limit the anteroposterior shift and rotation of the tibia (Camargo, et al. 2004).

Crackling, popping or small cracks in the water content of the legs, causing the cartilage to soften, break and splinter. This occurs in the loading and non-loading areas of the joint. Collagen fibers are broken and the normal collagen-proteoglycan relationship is disrupted.

As a result, water is sucked into the cartilage matrix, causing further softening and breakdown. Broken cartilage fragments float freely in fluid and can be impacted between joint surfaces, causing blockage, inflammation, and synovial irritation. Proliferation takes place at the periphery of the cartilage and the cartilage cells try to repair the damage, but the final product is not as resistant to pressure as the original cartilage. This initiates a series of pathological processes in other tissues (Porter, 2005).

Some of the effects on bones are the enlargement of blood vessels; osteophytes and new subchondral bone form mainly in the weight-bearing area at the periphery. The new bone flattens (burns) to form a cyst in which synovial fluid is under pressure through fluid cracks in the bone; these cysts are correlated with the joint (Golding, 2001).

Another effect on the joint capsules is that, if the disease progresses, they will undergo fibrosis and shortening of the adaptation. Although osteoarthropathy is, by definition, a degenerative and non-inflammatory disease, chronic low-grade inflammatory changes are usually reduced. Ligaments and joint capsules undergo the same changes and, depending on the joint affected, become shorter or longer.

If the joint space is significantly reduced, ligaments of sufficient length will become too long and will no longer be able to support and provide adequate proprioceptive feedback (Porter, 2005).

OSTEOARTHROSIS AND ITS ASPECTS

It is a chronic disease characterized by joint cartilage degeneration, pain and stiffness on movement (Vasconcelos and Dias, 2006). In osteoarthritis, whether primary or secondary, the cartilage is a deformed tissue that is larger than normal. In morphological alterations, the articular cartilage loses its homogeneity, breaks and is fragmented, with fibrillation, fissures and ulcerations.

It is most commonly found on the inside of the knee. Describe pain around and within the joint, as well as pain transferred to the distal ankle joint; osteophytes may be palpable, muscle spasms may be present in hamstring muscle tissue; patellofemoral rubbing sounds are common; the capsule pattern is loss of flexion and then elongation; prolonged spasm of the hamstrings, combined with joints that are more comfortable in slight flexion (loose fit), can lead to flexion deformities, usually vagus nerve or varus deformities; loss of full extension arc will cause loss of function, because of knee Requires full extension - fully adjusted position, standing for a long time, with minimal muscle activity; joints often become larger, quadriceps atrophy is common, especially the medial femoral muscle; due to pain, analgesic gait and tendency to joint failure, especially when standing; due to the narrowing of the joint space, the collateral ligaments actually become too long, making them unable to effectively control varus and vagus nerve movement. This instability can lead to permanent deformities and contractures, leading to adaptive shortening or lengthening of various tissues (Porter, 2005).

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GENICULAR BLOCKING

The word "genicular" refers to the arteries and nerves that supply sensation to the knee. For patients with osteoarthritis of the knee, the pain signals from these nerves can become unbearable.

The articulation and organization of the articular branches; the anterior and posterior parts described by Kennedy, Alexander and Hayes (1982), where the nerve branches of the anterior chamber come from the femoral nerve, the common peroneal nerve and the saphenous nerve, and the posterior chamber branches come from the tibial nerve, the obturator nerve and sciatic nerve (Horner and Dellon, 1994); form 5 nerves responsible for most of the sensitivity of the knee joint is called the geniculate nerve: superior medial, superior lateral, inferior medial, inferior lateral and recurrence of the tibia (Clement, 1985).

Yasar, et al (2015), accurately determined the topography of the medial, superior and inferior geniculate nerves, so that these small structures could be reached very accurately using ultrasound. Since these branches are intimately connected to easily identifiable anatomical bony landmarks, fluoroscopic access to the knee limb is considered the gold standard for needle placement (Choi et al. 2011; Protzman et al. 2014).

Genicular nerve block/neurotomy is considered a suitable non-surgical treatment

for many patients suffering from this type of pain. The procedure itself is very safe with minimal risk. The risk is generally low, but can include stray needles, bleeding, infection, drug allergies, nerve damage, and/or increased pain. They are very rare (Arkansas, 2021).

A genicular nerve block temporarily blocks nerve signals for knee pain. If you get effective nerve block pain relief, your doctor may recommend knee nerve ablation to treat knee joint pain.

During the genicular nerve block procedure, the doctor will point a needle into the superior medial nerve, superior lateral nerve and medial knee joint and inject a mixture of two anesthetics – lidocaine and macaine. This anesthesia numbs the nerves and prevents them from sending pain signals to the brain. That way, you may still experience pain, like arthritis, but you won't feel pain (Barr Center for Innovative Pain & Regenerative Therapies, 2019).

In the clinical trial conducted by Choi et al. (2011), the patient is placed in the intervention room, lying on his back on the fluoroscopy table and a pad is positioned on the popliteal force of the knee to relieve discomfort. The anterior and posterior arteries were examined with a fluoroscopy device and, after cutaneous and subcutaneous anesthesia, three 22-gauge needles were placed on the topographic map of the superior medial, superior lateral and medial inferior geniculate nerves.

The bony anatomical landmarks used to guide the puncture needle in "tunnel vision" are the external femoral epicondyle, the femoral adductor tuberosity, and the medial tibial condyle. The needles are introduced until they touch the bone and remain in the periosteum region, where they pass through the geniculate nerves.

The results obtained by Choi et al. (2011), showed according to the assessment of the visual analogue pain scale, 59% of the patients described a pain reduction of at least 50% after 12 weeks of intervention. At 4 and 12 weeks, daily symptoms measured by the Oxford scale were also significantly reduced compared with the control group ($p < 0.001$). The test group's satisfaction rating is also significantly higher.

In the case report by Protzman et al. (2014) reported results similar to those previously described in patients undergoing total knee arthroplasty, indicating that this population may also benefit from geniculate nerve intervention.

After surgery, you may notice swelling or pain around the injection site, but you must also note that typical knee pain is much less. The nerve block effect can last from several hours to several days.

Most patients must rest for the rest of the day, but you can resume normal activities as soon as you are ready. If the nerve block is successful and the knee pain is significantly reduced, you may reduce your use of painkillers and be able to do more activities with less pain, and then come to the conclusion that the nerve block went well. successful.

Once the nerve block is successful, the doctor will arrange for a neurotomy (nerve block). This is a process very similar to the previous one. Instead of numbing and blocking the nerve, the doctor will numb the nerve with a special needle (Arkansas, 2021).

In the investigation by Yasar, et al (2015), ten cadaveric knee specimens without surgery or major surgery were used in the study. The anatomical positions of the superior medial knee nerve and the inferior medial knee nerve were examined using the 4-joint knee anatomy.

The anatomical parts of the knee nerve identified in the remaining 6 parts of the knee joint were injected with 0.5 ml of red dye under ultrasound guidance.

Knee joint samples were further dissected to assess accuracy. If the nerve is stained with red ink, the placement is considered accurate. All other positions were considered inaccurate.

Therefore, the superior internal nerves of the knee curve around the femoral shaft, pass between the main adductor tendon and the medial epicondyle of the femur, and then descend to about 1 point anterior to the adductor tuberosity.

The medial hypoknee nerve is located around the medial condyle of the tibia and passes below it, the medial collateral ligament is at the midpoint between the medial tibial epicondyle and the tibial stop of the medial collateral ligament.

The adductor tuberosity of the superior medial nerve and the medial collateral ligament of the inferior nerve of the knee were determined as anatomical landmarks for the ultrasound examination.

The cortical bone one centimeter before the apex of the adductor tuberosity and the midpoint between the apex of the epicondyle on the tibia and the initial fiber inserted into the tibia of the medial collateral ligament is the target point of the superior collateral ligament.

The medial knee nerve and the inferior medial knee nerve were injected separately. At autopsy, both nerves in the knee were seen stained with red dye in all 6 knee injections (Yasar, et al. 2015).

They concluded that the results of this study on cadavers showed that the anatomical landmarks mentioned above can be used to accurately perform ultrasound-guided medial branch nerve block of the knee (Yasar, et al. 2015).

de Rooij, et al. (2016) summarized the pain process of patients with knee osteoarthritis, the prognostic factors that predict pain deterioration, the body function process, and the prognostic factors that predict deterioration of body function.

They found high heterogeneity between studies (I(2)>90%) and within the study population. Therefore, the process of pain and bodily function is interpreted as ambiguous. They found strong evidence for many prognostic factors that predicted pain deterioration, such as increased knee pain at baseline, bilateral knee symptoms, and depressive symptoms.

They also found strong evidence for many prognostic factors that predict deterioration in physical function, such as worsening radiological OA, worsening knee joint pain, decreased knee extension muscle strength, decreased walking speed, and increased blood count. comorbidities.

Rocha, et al. (2020), verified through a systematic review the effects it is used in the treatment of knee osteoarthritis pain and muscle strength. The studies included in the analysis included a total of 934 participants aged between 40 and 73, of whom 34.90% were men.

Most exercise groups used to treat OA have significant positive effects on these two items, but mostly on pain relief (statistically significant $p<0.003$). They concluded that pain improved in all muscle strengthening articles, but there are still obstacles to the protocol used.

In the procedure performed by Carlone, et al. (2021), 176 knees were identified that met the inclusion criteria and received a knee nerve block. Of these, 56 (31.8%) did not have pain relief greater than or equal to 50% during the initial block and did not undergo ablation.

Individuals who fail the initial block are more likely to have self-reported psychological comorbidities, including anxiety and depression ($p = 0.002$). Those who failed the block had a history of smoking

($p < 0.001$) and the proportion of patients with diabetes ($p < 0.001$) was also higher than that of patients successfully blocked. There were no significant differences between the two groups in terms of age, equivalent dose in milligrams of morphine, sex or body mass index.

Risks Associated with Genicular Nerve Block

For many patients with chronic knee pain, knee nerve block/neurotomy is considered a suitable non-surgical treatment. The program itself is safe and there are almost no risks. However, it is always important to understand the risks that exist (Arkansas, 2021).

Allergy to X-ray contrast agents and local anesthetics is the most common risk. Local bleeding at the injection site may also occur and the risk of infection, pain, redness or swelling at the injection site is low. In rare cases, nausea and dizziness may occur.

The most common risks related to genicular nerve block are:

- Needle displacement
- unexpected bleeding
- drug allergy
- Infection
- nerve damage

Aggravating the pain

However, the risks are extremely rare. With experienced and trusted pain management doctors to care for your surgery, the risk is even lower (Arkansas, 2021).

CONCLUSION

As the life expectancy of the world's population is increasing, joint diseases have become a very common disease. This has aroused the interest of researchers around the world in finding new drugs and treatments. Despite all the progress made, the main treatment for knee joint diseases is strengthening the muscles, controlling weight and educating patients about joint diseases.

This study showed that patients with chronic pain in the knee joint secondary to osteoarthropathy can achieve satisfactory pain control during intra-articular administration and through superior lateral, inferior medial and superior medial geniculate nerve blocks.

Thus, genicular nerve block is a potential therapeutic option for patients suffering from chronic pain from osteoarthritis of the knee that does not respond to conservative treatment or for patients who cannot undergo total knee arthroplasty due to overwhelming medical comorbidities.

In conclusion, the genicular nerve block proved to be an effective treatment and forms part of a multimodal pain management plan for many patients with osteoarthritis.

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