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Case Report

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# Management of Arthrofibrosis of the Knee after an Arthroscopic Meniscectomy with Paralytic Shellfish Poisoning Toxin. Case Report.

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## Abstract

**Objective:** The purpose of this study is to evaluate the use of paralytic shellfish poisoning toxin in a patient with arthrofibrosis of the knee. Arthrofibrosis is a common complication of knee surgery that tends to manifest itself as a limitation of the musculoskeletal ranges. Paralytic shellfish poisoning toxin has been proposed as an alternative treatment for painful musculoskeletal pathologies.

**Subjects:** Use of paralytic shellfish poisoning toxin in arthroscopic menisectomy. Case report.

**Methods:** Three doses of paralytic shellfish poisoning toxin were administered in an intra-articular manner on different days. Functionality, musculoskeletal ranges, pain at rest and pain during motion were evaluated.

**Results:** The current alternatives for management of arthrofibrosis include the use of oral steroids, physiotherapy, mobilization under anesthesia and the liberation of arthroscopic debris. This case is the first report of the use of paralytic shellfish poisoning toxin. The adverse effects the patient presented coincided with those described in the literature but without the presence of severe reactions.

Improvement in functional tests, progress in musculoskeletal ranges and a decrease in the level of pain were achieved. Adverse effects included parenthesia and a feeling of weightlessness.

**Conclusions:** Arthrofibrosis is a difficult complication to manage in which case early treatment focused on pain management is suggested. We believe that paralytic shellfish poisoning toxin is a safe and useful tool for managing arthrofibrosis.

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**Keywords:** Paralytic Shellfish Poisoning Toxin (Neosaxitoxina); Arthroscopic meniscectomy; Meniscectomy; Mobilization under anesthesia (MUA).

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## Introduction

There are many definitions for arthrofibrosis in the literature; however, one of the most frequently used definitions corresponds to the presence of scar tissue in at least one of the knee compartments which unfavorably affects the range of motion of the joint [1-4]. Arthrofibrosis is a common complication in knee surgery to such an extent that it is the most common complication in reconstructive surgery of the anterior cruciate ligament [1]. There are no formal reports in the literature with regards to the incidence in relation to presentations after an arthroscopic meniscectomy.

In most cases, it clinically manifests as a limitation of the musculoskeletal ranges of the knee subjected to surgery, but, it should also be suspected in patients suffering more pain than expected during postoperative rehabilitation [5, 6]. In the literature, management alternatives for arthrofibrosis such as the use of oral steroids, physiotherapy, manipulation under anesthesia and surgical procedures such as the liberation of intra-articular debris have been described [5].

Over the past 20 years, there has been significant interest in the use of toxins originating from plants, animals, and even microorganisms which have been administered in animal subjects with the purpose of evaluating their use for diverse clinical conditions. One of the best known is the use of botulinum toxin.

Paralytic shellfish poisoning toxin (Neosaxitoxina) is a biotoxin whose toxicity is a result of its reversible bond with *voltage-dependent sodium channels in excitable cells* [7]. These channels are fundamental for the neurotransmission of neuronal synapses and neuromuscular bonds; therefore, the blockage of these two physiological processes through the use of paralytic shellfish poisoning toxin explains its two effects in its clinical administration: pain management and control of muscle hyperactivity (muscle relaxant effect) [8]. In recent literature, its safety and efficiency have been proved in its use for diverse painful pathologies [9].

The purpose of this study was to evaluate and describe the clinical results of the administration of paralytic shellfish poisoning toxin in a patient who developed arthrofibrosis of the knee after an arthroscopic meniscectomy.

## Clinical Case

A clinical case of a 36-year-old female patient, without morbid background, who presents an acute lesion of the posterior horn of the medial meniscus in the left knee. A knee arthroscopy was performed on April 4, 2017, revealing a white zone lesion that required a partial meniscectomy arthroscopically.

After surgery, the patient presented a deficiency in the flexion and extension of the knee and a poor functional outcome despite 30 sessions of motor physical therapy and pain relief medication. Consequently, a joint mobilization procedure was performed under general anesthesia on June 29, 2017, during which full ranges of motion of the joint were achieved. However, after two weeks and ten sessions of motor physical therapy, and after the mobilization under anesthesia (MUA), the patient achieves a slight improvement in the flexion and extension of the knee and its level of functionality.

An intra-articular infiltration of paralytic shellfish poisoning toxin was proposed as a therapeutic alternative.

## Management and Results

A paralytic shellfish poisoning toxin administration protocol was performed in the following manner:

- Day 0: (July 20, 2017): infiltration using a syringe with 40 µg of Neosaxitoxina mixed with 100 mg of lidocaine (a 2% / 5ml vial).
- Day 12: infiltration using a syringe with 20 µg of Neosaxitoxina mixed with saline solution 0.9%.
- Day 49: infiltration using a syringe with 20 µg of Neosaxitoxina mixed with saline solution 0.9%.

A *goniometer* is an instrument that measures angles, and it was used in this study to measure knee range of motion of the patient.

To assess the functional outcome three internationally validated scales were used: Lysholm Knee Scoring Scale, IKDC Subjective Knee Evaluation Form, Tegner Activity Level Score.

The analgesic effect became evident within the first few minutes of administration when the patient stated that the intra-articular pain, which had been previously present during flexion and extension, had disappeared. However, the patient presented extra-articular pain in musculoskeletal structures (lateral gastrocnemius tendon, goosefoot tendons, among others).

According to the patient's feedback, the analgesic effect of the first injection lasted approximately ten days, the effect of the second infiltration lasted four days and the third dose seven days.

In Table 1, the evaluation of different clinical and functional parameters can be seen after the patient was subjected to a spectrum of therapeutic procedures.

The adverse effects presented by the patient were minor and appeared within the first 15 minutes of administration. These included, among others, paresthesia of the lips, face, and fingertips, in addition to a sensation of "weightlessness". These effects ceased within 24 – 48 hrs. after infiltration. The patient did not present severe cardiovascular, respiratory or neuromuscular adverse effects.

## Discussion

This case is the first report of the use of paralytic shellfish poisoning toxin in knee arthrofibrosis treatment. Pain management is fundamental to achieve a range of motion of the joint. Complementing physiotherapy treatment with intra-articular paralytic shellfish poisoning toxin was crucial in order to obtain the clinical result.

Table 1. Clinical and functional parameters used to compare the response to different therapeutic procedures.

| | **Post-arthroscopy** | **Post-MUA** | **Post- 1st dose** | **Post- 2nd dose** | **Post-3rd dose** |
|---|---|---|---|---|---|
| **VAS at rest** | 5/10 | 1/10 | 1/10 | 0/10 | 1/10 |
| **VAS flexion** | 8/10 | 5/10 | 3/10 | 2/10 | 2/10 |
| **Active flexion/ passive flexion range** | 80°/95° | 100°/116° | 100°/125° | 125°/130° | 125°/135° |
| **Extension range** | -5° | -2° | 0° | 0° | -2° |
| **Functionality tests** | | | | | |
| **IKDC** | 20.7 | 51.7 | 71.3 | 71.7 | 71.3 |
| **Lysholm** | 27 | 74 | 85 | 85 | 85 |
| **Tegner** | 0 | 2 | 3 | 3 | 4 |

*VAS: visual analogue scale (scale of subjective evaluation of pain intensity, minimum 0, maximum 10).

Arthrofibrosis is an uncommon but devastating complication after knee surgery. It is defined as the loss of full extension or 15° less of flexion with regards to the contralateral knee after three months of surgery [10].

Mobilization under anesthesia is the most commonly used treatment for arthrofibrosis. Several studies have evaluated its outcomes after a total knee arthroplasty [11-14], however, the results have been variable. It has been proven that better results are achieved when MUA is performed soon (12 weeks after surgery) [15]. Notwithstanding, it is not uncommon for patients to present stiffness even after this procedure. In these cases of poor response, some authors have suggested a second MUA [14]. In the present clinical case, the patient achieved full ranges of motion of the joint during MUA procedure, however, the day after, pain during rehabilitation procedure restricted once again the active and passive range of motion. Pain management is crucial to maintaining the range of mobility obtained after MUA.

Other interventions are arthroscopic arthrolysis and corticoid infiltration. The former is the last resort when no range of motion is obtained under anesthesia, or a fibrous tissue is seen in a Magnetic Resonance. It is a surgical procedure which has the disadvantage of being invasive and it is reserved for use when no other treatment has been successful [16]. Corticoid injection is widely used, but different studies have shown no satisfactory results, even if used in early stages [17].

In this novel treatment, we use intraarticular administration of Neoxasitoxin 1 month after an unsuccessful MUA. It was very useful in pain control and facilitated the treatment with a physiotherapist, achieving satisfactory results. Another option would be the use of a continuous femoral catheter; however, it has the disadvantage that the patient must have a route during the entire treatment with the ensuing risk of complications, such as infection, and in most parts of the world, it is done in an intrahospital manner [18]. On the other hand, intra-articular administration with Neosaxitoxin has a lower risk because it can be administered independently due to its higher time of action in pain control.

With regards to the use of paralytic shellfish poisoning toxin, the safety of its administration in human and animal subjects has been reported [19]. Furthermore, Neoxasiton efficiency in pain control and management has proven and it has been tested in different pathology with excellent results in the treatment of diverse clinical conditions such as anal fissures [20-22], chronic tension headaches [23], and postoperative analgesia for total knee arthroplasties [24]. That is to say, it has demonstrated to be highly useful for managing pain in different scenarios. The adverse effects the patient presented coincided with those described in the literature [24], not only regarding the time frame of appearance but in its duration as well.

Within the context of the patient, who under anesthesia achieved practically a full range of passive motion and given that the primary cause for a decrease once again in the range of motion of the joint was due to pain, paralytic shellfish poisoning toxin was prescribed as part of the treatment in order to optimize physiotherapy and in this way, achieve improved functionality.

Given the results observed in the patient, we believe that these were satisfactory with regards to the achievements in musculoskeletal ranges, functionality and pain relief. The development of this case leads us to think that an intraarticular dose of Neosaxitoxin should be applied immediately after MUA for pain control and by this means, achieve successful results in a shorter term. This protocol is the way to follow this line of research.

## Conclusions

Arthrofibrosis is a challenging complication to manage in postoperative patients. There is no precise management algorithm; however, there is a consensus that treatment must be commenced as early as possible with pain management being fundamental. We consider paralytic shellfish poisoning toxin to be a safe and useful tool for managing arthrofibrosis. It provides pain relief thus permitting the optimization of rehabilitation.

## Conflict of interest

We declare no conflicts of interest.

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