

Patellofemoral pain: treatment by arthroscopic patellar denervation

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Introduction. This study presents a new arthroscopic technique for the treatment of patients with patellofemoral pain together with our experience of the procedure and the preliminary results of arthroscopic patellar denervation in patients with intractable patellofemoral pain we have obtained.

Materials and methods. Ten patients with patellofemoral pain and no evident alterations (8 women, 2 men; mean age 33 years) were treated by arthroscopic patellar denervation, involving a thermal lesion to the peripatellar soft tissue.

Results. Considerable functional improvement was obtained in all cases. At six months after the procedure, all patients had resumed their normal daily activities and the younger patients were able to do sports without difficulty. None of the patients showed any clinical changes during the two-year follow-up period.

Conclusions. Patellar denervation may be the solution for cases of intractable patellofemoral pain without evident alterations. The technique described in this study is simple to perform and safe. As with other arthroscopic procedures, morbidity is low. This is a preliminary study in a small number of patients, but the results warrant further study with a control group and long-term follow up.

Key words: *patellofemoral pain, chondromalacia patellae, arthroscopy, denervation, knee.*

Dolor fémoro-rotuliano. Tratamiento mediante denervación rotuliana artroscópica

Introducción. El objetivo de este estudio es presentar una nueva técnica artroscópica que permite el tratamiento de pacientes con dolor fémoro-rotuliano, y nuestra experiencia y los primeros resultados de la denervación rotuliana artroscópica.

Material y método. Se presentan 10 pacientes (8 mujeres y 2 hombres; media de 33 años) con dolor fémoro-rotuliano y sin causas evidentes que justifiquen su clínica, tratados mediante denervación rotuliana artroscópica.

Resultado. Se ha conseguido una mejoría significativa clínica y funcional en todos los casos. A los 6 meses todos los pacientes habían vuelto a sus actividades cotidianas sin dificultad, incluida la práctica deportiva sin limitaciones. A los dos años de evolución no se han observado cambios clínicos.

Conclusiones. La denervación rotuliana artroscópica es una alternativa válida de tratamiento para aquellos casos que presentan dolor fémoro-rotuliano sin alteraciones evidentes. La técnica que se describe es sencilla y segura; al igual que todas las técnicas artroscópicas presenta una escasa morbilidad. A pesar de los buenos resultados el número de pacientes es escaso y es necesario completar el estudio.

Palabras clave: *dolor fémoro-rotuliano, condromalacia rotuliana, artroscopia, denervación, rodilla.*

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The patellofemoral syndrome can have many causes and is frequently seen in adolescents and young adults without an underlying disorder that could explain it. In this group of patients patellofemoral pain is frequently associated with *chondromalacia patella*.

Anatomical studies carried out at the beginning of the eighties on patellar innervation^{1,2} led some physicians to

think of the possibility of solving the problem by means of selective neurotomy of the sensitive patellar branch of the internal saphenous nerve³. In spite of good initial results, in almost 50% of cases discomfort recurred, since the nerve branches that reach the patella have a highly variable anatomic distribution.

Studies carried out by Fulkerson⁴ on the pathophysiology of patellofemoral pain detected the presence of nociceptive afferents in the soft tissues of the knee. Subsequent immunohistochemical studies of the innervation of the human knee carried out by Wojtys⁵ located these fibers in the peripatellar soft tissues, in the periosteum and in degenerative subcondral bone. More recent immunohistochemical studies of the innervation in the anterior region of the knee in patients with patello-femoral pain have detected hyperinnervation of peripatellar soft tissues^{6,7}.

Keeping in mind the peripatellar distribution of pain receptors, if there is a lesion in this region it may be possible to achieve, theoretically, desensitization or denervation of the anterior region of the knee.

The aim of this study is to present an arthroscopic technique for patellar denervation and our experience in the treatment of patellofemoral pain by means of arthroscopic patellar denervation.

MATERIALS AND METHODS

During 2002 and 2003, we operated 10 patients for patellofemoral pain. These patients had no apparent alterations to explain the pain, either visible on simple X-ray (antero-posterior, lateral and axial at 45° views and telemetric studies) or visible by magnetic resonance imaging. The series was formed by 8 women and 2 men and their mean age was 33 years of age (24-49). The affected knee was predominantly the left (9/1) and no patient had both knees affected. All the patients had undergone conservative ambulatory treatment before coming to the hospital services. None of the patients had seen an improvement in their symptoms after 3-6 months of treatment and rehabilitation carried out in hospital facilities.

We assessed results using the Grana scale for patellofemoral pain⁸ (Table 1): this scale classifies results based on limitation of activity due to pain. Furthermore, we used the Outerbridge Classification to assess the degree of lesion of patellar cartilage⁹.

During preoperative clinical exams all patients were in Grana categories D and E. They all reported pain on ascending or descending stairs, on kneeling, or sitting for prolonged periods of time, and felt the need to stretch their leg to alleviate pain. In patients who practiced a sport, the pain began after 10 to 15 minutes of continuous running, and limited their sports activity from that moment on.

Table 1. Grana assessment of patellofemoral pain

A. No pain, no activity restrictions
B. No limiting pain when extreme activity is carried out
C. Extreme activities possible but limited by pain
D. No restrictions of daily living activities, but there is restriction of extreme activities
E. Limited daily living activities

We considered extreme activity to be sports or the use of stairs to go up or down 2 stories. Satisfactory results: A - B; unsatisfactory results: C - D - E.

During exploration all patients reported pain on forced mobilization of the patella. In the 2 oldest patients it was possible to see slight atrophy of the quadriceps muscle in comparison with the muscle of the contralateral leg, in spite of specific rehabilitation.

Diagnostic arthroscopy with arthroscopic patellar denervation was performed in all patients¹⁰. The usual ports were used (antero-external and antero-medial): through the antero-external port it is possible to see almost all the joint facets of the knee. The use of other suprapatellar ports (external and internal) may be added to those mentioned. Instruments are introduced through the antero-internal and suprapatellar ports. Using the combination of arthroscopic ports mentioned it is possible to access the whole patellar perimeter to carry out thermal treatment, using an arthroscopic electrocoagulator, of the peripatellar soft tissue nearest the patella (Figure 1). In all cases no thermal procedure was performed on the region of the patellar tendon which was preserved intact. It is difficult to visualize this structure arthroscopically due to Hoffa's fatty tissue, occasionally hypertrophied, and we also considered that there was a high risk of damaging the patellar tendon and the vessels that irrigate the patella and run through it.

Arthroscopic findings were:

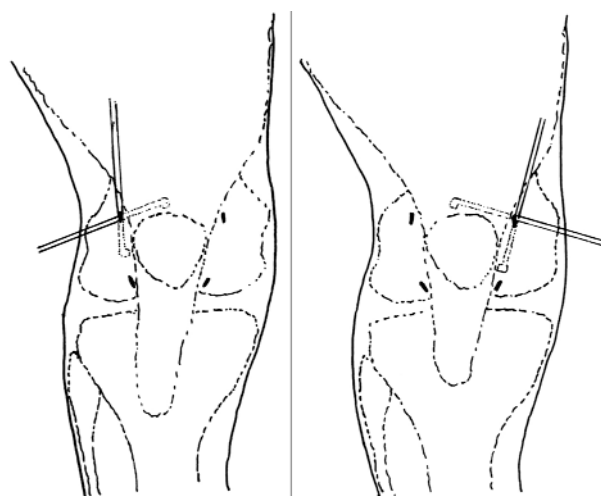


Figure 1. Combining the different suprapatellar and anterior ports the electrocoagulator can easily access peripatellar soft tissue..

- 1) Discrete synovial hypertrophy of the anterior compartment of the knee in 4 patients.
- 2) Degenerative changes of the internal meniscus in the oldest patient.
- 3) Patellar chondropathy (Grade I in 6 patients, grade II in 2 patients and grade III in the 2 oldest patients).

After surgery partial weight-bearing was allowed with the aid of crutches for 2 weeks, and a rehabilitation process was initiated similar to the one used after simple arthroscopic meniscectomy. Due to the fact that there was a decrease in volume of the quadriceps muscle in all patients, a series of exercises for this muscle were included in the rehabilitation.

Six months after surgery, according to assessment using the Grana scale, 7 patients were in category A, 2 in category B and 1 in category C. Therefore, the clinical result was satisfactory in 9 patients and unsatisfactory in 1 patient (the oldest). All patients reported a marked improvement, they had all returned to their normal activities without any pain. Only the oldest patient reported pain, which did not limit his daily living activities. The 5 youngest patients sporadically practiced sports, and did not suffer limitations or pain when doing so.

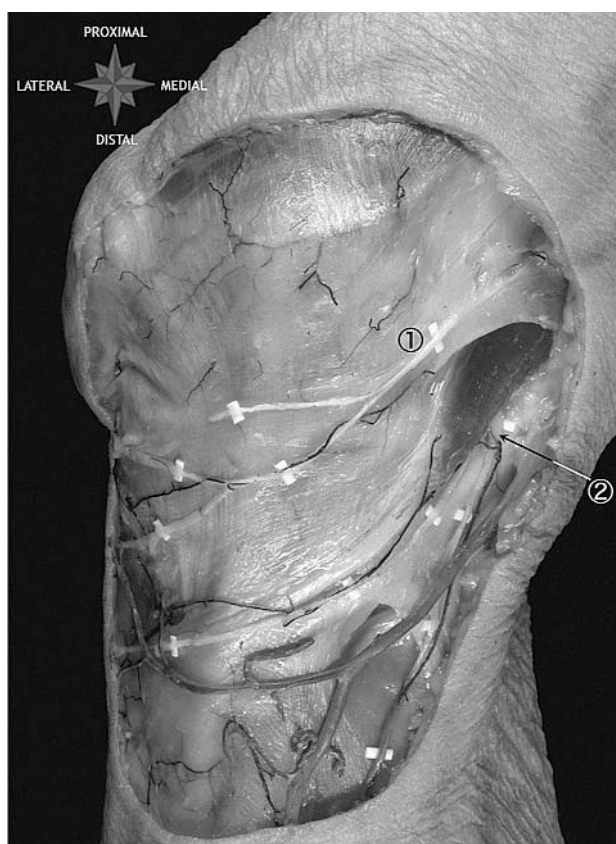


Figure 2. Anatomical dissection of the anterior region of the knee. It is possible to see the deep innervation of the anterior region of the knee with the infrapatellar branch of the internal saphenous nerve (1) and an accessory infrapatellar branch (2).

On physical exam there was no pain when patellar mobilization maneuvers were performed, except in the 2 oldest patients who still had some discomfort. No major complications were seen.

Two years after surgery no changes have been seen clinically or on exploration, and the Grana scores are the same as those seen postoperatively. No radiological changes in patellofemoral dynamics or any signs of patellar avascular necrosis have been seen.

DISCUSSION

Denervation as a treatment for pain is not new, it is used in chronic spine pain, trigeminal neuralgia and in some cases of intractable wrist pain.

Anatomical studies of the distribution of the patellar nerves show that there is marked variability of their distribution on the medial border, and, especially, on the lateral border of the patella^{1,2}. On the medial aspect innervation is provided by the internal saphenous nerve, one of the main branches of the crural nerve. The internal saphenous nerve has a variable anatomical distribution, it has 3 branches: the superficial or accessory arterial branch (seen in 20% of specimens), the retromuscular or accessory venous branch (seen in 60% of cases) and the deep or infrapatellar branch (seen in 20% of cases) (Figure 2). Anatomical variability is even greater on the lateral border of the patella. On the inferior-lateral border of the patella no specific innervation has been found, whereas in the upper half it seems that innervation is supplied by 2 branches: the joint branch of the nerve that innervates the *vastus lateralis* muscle (branch of the quadriceps nerve that is a branch of the crural nerve) and the patellar plexus (a nerve plexus formed by intercommunicating terminal branches of the lateral femoral cutaneous nerve and the infrapatellar branch of the saphenous nerve, both branches of the crural). Due to this high degree of anatomical variability, a selective neurotomy does not lead, in most cases, to patellar desensitization³. Therefore, it seems more logical to achieve denervation damaging the pain receptors that are located in the peripatellar tissue, as shown in studies carried out by Wotjys⁵.

Femoro-patellar pain is an entity that is difficult to treat due to its great variety of possible causes, but occasionally it is not possible to determine the cause. A large group of patients within this category suffer so-called *chondromalacia patella* (patellar grade I chondropathy) frequently seen in adolescents and young adults. Dugdale¹¹ pointed out that in all likelihood *chondromalacia patella* was overestimated as the probable cause of patellofemoral pain in young people, when it was more probable that inflammation or irritation of peripatellar tissues was the cause of this symptom (this hypothesis is confirmed by the relative frequency with which pathological softening of the patellar cartilage is seen

in asymptomatic individuals). In general, these patients are treated conservatively, by means of exercise programs^{12,13}; and only when this is not effective is surgery considered.

More than 100 surgical procedures to treat patellofemoral pain have been described. Most of these techniques have the aim of realigning the extensor system or treating cartilage lesions.

The use of arthroscopy to treat anterior knee pain is not very extended, and in many cases its use is limited to diagnostic purposes. Joint lavage during arthroscopy achieves initial good results, but these disappear in a short time¹⁴.

Arthroscopic patellar *debridement* has been used in some cases of patellofemoral pain, and is effective in patients with evident signs of chondropathy, especially when it was caused by trauma^{14,15}. However, the beneficial effect initially achieved in these patients with *chondromalacia patella* of non-traumatic origin is not maintained over time¹⁵. In some series, section of the external patellar wing is added^{8,14,16} to this treatment of arthroscopic *debridement*.

Section of the external patellar wing has been used, in an isolated fashion, as treatment for cases of patellofemoral pain without alterations¹⁷, and good results are seen in up to 50% of cases according to some series^{14,16}. However, it is not indicated in this group of patients. We consider that the good results seen when section of the external patellar wing is performed in the cases in these series are due, in many cases, to the fact that there is an undetected minimal alteration of patellar dynamics or patellar misalignment and, furthermore, that denervation is also achieved when carrying out this procedure.

Arthroscopic patellar denervation¹⁰ is performed with the aim of decreasing pain sensitivity of the anterior region of the knee. To achieve this, thermal damage is caused to the peripatellar soft tissues, which are rich in pain receptors. In this manner satisfactory clinical results are achieved in all cases of patellofemoral pain associated to low grade chondropathy, allowing patients to return to the practice of sports. In the only operated patient that had signs of degenerative processes of both cartilage and menisci, although these improved, the results of the procedure (assessed by the Grana scale) were unsatisfactory. As has been stated by Ogilvie-Harris¹⁴, the effusion from cartilage debris in the joint of patients with degenerative chondropathy leads to synovitis, which could be the cause of the unfavorable results seen in these patients. As with other arthroscopic techniques, the low morbidity and great comfort it brings about makes this procedure very popular amongst patients, which is not the case for more aggressive procedures. Furthermore, arthroscopic patellar denervation has other advantages, such as not interfering with patellar dynamics and making it possible to perform other surgical techniques if necessary.

The lesion caused by the electrocoagulator on the peripatellar tissue achieves sufficient depth to damage the most superficial pain receptors¹⁹. For this reason it is considered that there is not complete denervation, just desensitization.

In this way, the patient does not completely lose sensitivity to pain or proprioceptive stimuli; we therefore do not believe that this procedure favors evolution of neurogenic arthropathy and subsequent patellofemoral.

This surgical procedure partially alters the patellar blood-supply¹⁹, but as it does not damage deep blood vessels or the entrance of the blood vessels into the patellar tendon the risk of complications due to blood-supply alterations is minimal.

The atrophy of the thigh muscles, not considered a complication of surgery, must be interpreted as secondary to the desensitization caused by the technique.

We do not consider that this muscular atrophy (in most cases slight to moderate) has worsened or slowed down postoperative patient evolution. In young patients thigh muscle volume and strength recovered easily with the use of a specific exercise program.

Currently, we do not know how these patients will evolve in the long term, but we have not observed any deterioration of their condition in the 2 years follow-up since surgery.

Although performing isolated arthroscopic patellar denervation is effective in patients with patellofemoral pain that had no underlying alterations to explain its cause, it is possible that this technique can be added to other surgical procedures for the treatment of pain in the anterior region of the knee due to other causes.

In conclusion, based on the results obtained, we consider that the main indication for arthroscopic patellar denervation is patellofemoral pain in young patients with no underlying alterations or with a low grade non-traumatic *chondromalacia patella* or chondropathy. However, it is necessary to keep in mind the small number of patients in this series and, above all, the need for further assessment in the long term. Meanwhile we can affirm that it is a valid treatment that must be kept in mind for use in this group of patients, who until now had to limit their activities and resign themselves to suffering pain and discomfort.

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Conflict of interests

The authors have declared that they do not have any conflict of interests.