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ORIGINAL ARTICLE

Evaluation of Results of Arthroscopic Patellar Denervation for Treatment of Patellofemoral Pain

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Background One of the most prevalent knee diseases among patients who visit orthopedic practitioners is patellofemoral pain. A minimally invasive procedure that preserves the joint, arthroscopic patellar denervation, may help with anterior knee painy.

Objective To evaluate the results of the denervation of patella in patients with patellofemoral pain by arthroscopy.

Patients and Methods A randomized study included 21 patients who have arthroscopic denervation of the patella, at the orthopedic department of Menoufia University Hospital during the period from March 2022 till March 2023.

Results After 6 months (17.9±15.69) and 12 months (15.3±14.69), the visual analog scale score for pain considerably decreased in comparison to the preoperative score (81.4±5.04) (P<0.001). Additionally, there was a substantial rise in both Kujala and Lysholm ratings during the follow-up period compared with the preoperative period (P<0.001). Furthermore, two (9.5%) patients had patellar malalignment, and one (4.8%) patient had arthritis, based on radiography results at one year of follow-up. Postoperative problems included hemarthrosis in two (9.52%) individuals and quadriceps muscle atrophy in four (19.05%) patients.

Conclusions Arthroscopic patellar denervation appears to reduce anterior knee pain and enhance clinical and radiological results, according to the data. To validate these findings, more extensive long-term prospective comparison series are required.

Keywords Chondromalacia, Osteoarthritis, Patellar denervation, Patellofemoral pain.
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INTRODUCTION

Anterior knee pain is a multifactorial condition with a broad range of potential causes. The most common causes include patellofemoral pain (PFP) syndrome, patellar tendinopathy, osteoarthritis (OA), and chondromalacia patellae, with contributing factors such as overuse, muscle imbalances, trauma, and alignment abnormalities.

Anterior knee pain is a frequent complaint, affecting ~25% of individuals at some point in their lives.

20–40% of adolescents report knee pain.

50% of athletes report experiencing some form of knee pain during their careers.

Females at Higher Risk: females are more likely to suffer from anterior knee pain than males. The ratio is ~2:1 to 4:1 for females to males in specific conditions like PFP syndrome.

As a natural shock absorber, the cartilage can deteriorate and break down more quickly due to several circumstances, including injury and misuse. It causes pain

to move and utilize since the cartilage is no longer smooth. Although it frequently affects young people playing strenuous sports, older people who overwork their knees can also get it [1]. PFP syndrome and chondromalacia patellae are occasionally used interchangeably. There is general agreement, therefore, that PFP syndrome only affects people who do not have cartilage injuries.

The nerve supply to the patella, particularly through the femoral nerve and its branches, is critical in the pathophysiology of patellofemoral arthrosis. This nerve network facilitates the transmission of pain signals from the degenerating joint, contributing to the hallmark symptoms of pain and dysfunction. The sensitivity of these nerves, especially in the setting of cartilage degradation, plays a significant role in the clinical presentation of the condition.

Chondrosis is another name for this illness [2]. Numerous pathophysiologic factors influence PFP, which can be challenging to treat. In young people, it frequently happens for no apparent reason [3].

Plain radiographs of the knee can only show signs of OA affecting the patellofemoral joint in advanced stages of the illness; they cannot directly evaluate for chondral alterations. There can be a palpable joint effusion. When evaluating for shallow excavation in the subchondral bone including the patella, lateral and skyline views are more useful. The preferred method for evaluating patellar cartilage is MRI [4]. This article describes a novel arthroscopic procedure for treating patients with PFP with little to no malalignment, which is based on anatomic and pathophysiologic research. The peripatellar soft tissue has a rich distribution of nociceptive receptors. We hypothesized that a thermal injury to this area would cause patellar denervation (PD) or desensitization of the anterior knee region [5].

Numerous nociceptive receptors can be destroyed by a straightforward thermal injury to the peripatellar soft tissue in the area next to the patella. Since the patellar tendon is a key point of entry for vessels that reach the patella and damage to these vessels may result in patellar necrosis, the area should not be included in this thermal lesion. For individuals with uncontrollable PFP who show no change, PD accomplished with this straightforward method may provide a remedy [6]. The purpose of this study is to assess how well arthroscopes perform patella denervation in patients with patellofemoral discomfort.

PATIENTS AND METHODS

A prospective cohort study study included 21 patients who had arthroscopic denervation of the patella, at the orthopedic department of Menoufia University Hospital during the period from March 2022 to March 2024.

Ethical consideration

Everything was done by the institutional committee's ethical guidelines, the 1969 Helsinki Criteria, and the 2008 revisions. The Menoufia University Faculty of Medicine's Ethical Committee gave its approval to the study. The purpose and procedures of the research were described to all participants and following an explanation of the study's nature and scope, all parents provided signed informed consent.

Patients' criteria

We included all patients (male and female) over 20 years of age who reported PFP with grade II and III patellofemoral arthritis, provided they were anesthetically fit, had no prior history of surgery on the affected knee, and had no related injuries to the affected knee. We did not include, however, patients under the age of 20, patients who were not suitable for anesthesia, patients with a history of arthroscopic procedures or old knee fractures, patients who had previously had surgery on the affected knee, patients with uncontrolled diabetes mellitus or peripheral neuropathy, and patients with advanced OA in the knee.

Medical records reviewed for

Preoperative information includes medical history (age, sex, occupation, and comorbidities), clinical examination (local, general, inspection, and palpation), special tests (Patella Apprehension, Brush, and Clarke's tests), and radiological evaluation (MRI and plain radiograph).

Surgical technique

Anesthesia

Once spinal anesthetic is administered, the patient is positioned in a supine position. Antibiotic prophylaxis: preoperative injections of antibiotics were given to every patient. Tourniquet and preparation: to stop bleeding, a tourniquet is used. At the end of the operating table, the knee is positioned in a knee holder. Following cleaning, the extremity is sterilely draped. A simpler treatment was made possible by the removal of fat tissue from the patella's distal pole. To reach the entire patella, electrocoagulation is through anterolateral and suprapatellar portals. Many pain receptors were removed by a straightforward thermal injury to the peripatellar soft tissue in the area nearest the patella. The electrocoagulation was coagulated to prevent potential bleeding. Because postoperative hemarthrosis is not a usual problem in arthroscopic PD (Figures 1, 2).

Superior lateral genicular vessels can be at risk of injury during the procedure, leading to potential complications such as excessive bleeding, hematoma formation, or postoperative swelling.

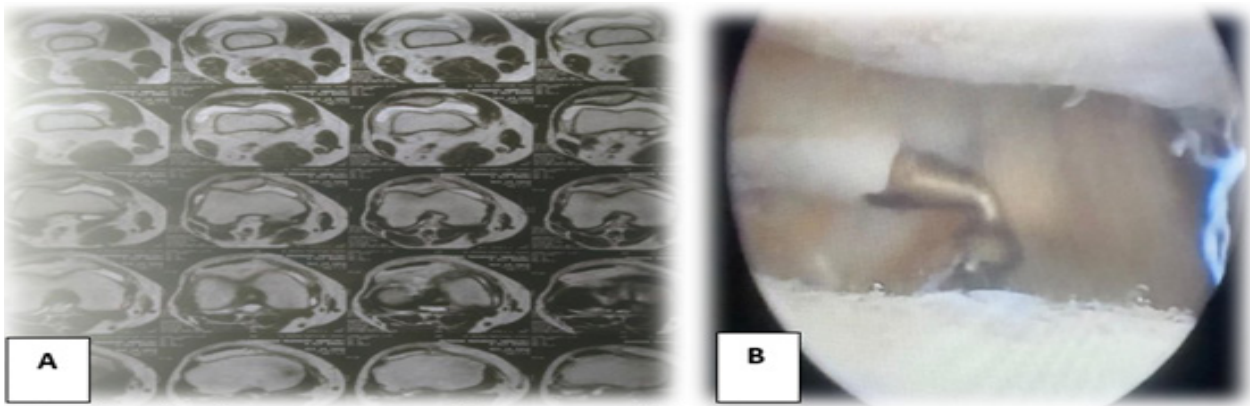

Figure 1: Male patient aged 50 years old with anterior knee pain due to chondromalacia; (A): MRI Axial view Showing Chondromalacia; (B): Intraoperative arthroscopic patellar denervation.

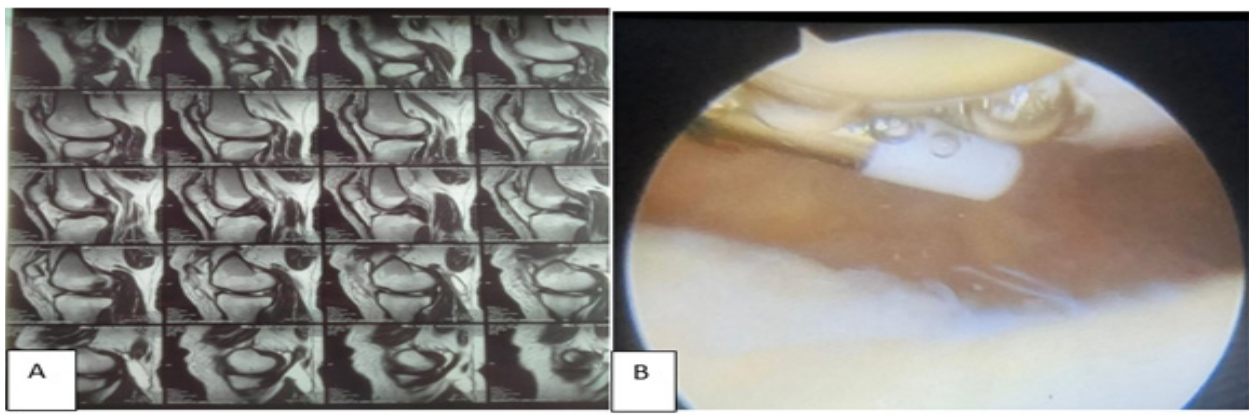

Figure 2: Female patient aged 42 years old with ACL injury; (A): MRI sagittal view showing ACL tear; (B): Intraoperative arthroscopic patellar denervation.

Intraoperative measures

Tourniquet Application, Precise portal placement (the portals are placed far enough from the vessels can reduce the risk of accidentally damaging the superior lateral genicular arteries), Precision Cauterization (the superior lateral genicular artery is usually small, so electrocautery can help seal off smaller branches that may cause minor bleeding).

Postoperative measures

Compression and Elevation: After the procedure, the knee should be elevated and compressed to help control swelling and prevent postoperative bleeding.

In certain cases, a drain can be placed to allow the drainage of residual blood or fluid.

Postoperative data including an elastic bandage, last for 3 or 4 days. During the first several days following surgery, quadriceps workouts and knee flexion extensions are advised. The duration of antithrombotic prophylaxis is 10 days.

Outcome measures

Visual analog scale (VAS), Kujala, and Lysholm are used to provide a comprehensive assessment of a patient's knee condition, we assessed a patient's pain levels, functional abilities, and overall knee function.

Statistical analysis

SPSS version 21 was used to compile and analyze all of the data (SPSS Inc., Chicago, Illinois, US). For quantitative data, the data description format was mean±SD; for qualitative data, it was frequency and percentage. The total of all observations divided by the total number of observations is the mean. On the other hand, the SD quantifies how widely apart each variety is from its mean. A *P* value of less than 0.05 was considered statistically significant.

RESULTS

The average age of the patients was 31.9±8.12 years, the average BMI (kg/m^2) was 24.38±2.83, 28.6% of the patients were men and 71.4% were women, and 38.1% of the patients had the left-sided disease and 61.9 had right-

sided disease (Table 1). Arthroscopic results showed that 9.5% of patients had no chondromalacia, 19.1% had grade 2 chondromalacia, and 71.4% had grade 1 chondromalacia. MFC chondromalacia G 1, MFC chondromalacia G 2, medial plica, MM horizontal tear, and flap tear MM were seen in an equal percentage (4.8%) of patients (Table 2).

Table 1: Distribution of patient characteristics data in the studied group:

	Studied group (*N*=21)
Age (years)	
Mean±SD	31.9±8.12
Sex, *n* (%)	
Male	6(28.6)
Female	15(71.4)
BMI (kg/m^2)	
Mean±SD	24.38±2.83
Side of injury, *n* (%)	
Left	8(38.1)
Right	13(61.9)

SD: Standard deviation.

Furthermore, VAS scores showed a statistically significant decline over the course of the follow-up. Compared with preoperative (81.4±5.04), pain using the VAS score considerably decreased after 6 months (17.9±15.69) and after 12 months (15.3±14.69) (P<0.001). Additionally, compared with preoperative, both Kujala and Lysholm scores grew significantly during the follow-up (P<0.001) (Table 3). Furthermore, radiography results at 1-year follow-up showed that two (9.5%) patients had patellar malalignment, and one (4.8%) patient had arthritis alterations (Table 4). Additionally, there were no postoperative problems in 15(7142%) patients, quadriceps muscle atrophy in four (19.05%) patients, and hemarthrosis in two (9.52%) individuals.

Table 2: Distribution of arthroscopic findings in the studied group:

	Studied group (*N*=21) [*n* (%)]
Chondromalacia	
No	2(9.5)
G1	15(71.4)
G2	4(19.1)
Others	
No	16(76)
Flap tear MM	1(4.8)
Medial plica	1(4.8)
MM horizontal tear	1(4.8)
MFC chondromalacia G 1	1(4.8)
MFC chondromalacia G 2	1(4.8)

Flap tear MM = flap tear of the, MFC chondromalacia= medial meniscus medial femoral condyle G= grade.

Table 3: Distribution of visualanalog scale, Kujala and Lysholm scores in the studied group:

	Studied group (*N*=21)			
	Preoperative	**After 6 months**	**After 12 months**	***P* value**
VAS score				
Mean±SD	81.4±5.04	17.9±15.69	15.3±14.69	<0.001*
Median	82	12	9.5	
Range	68-90	3-70	2-65	
Kujala scores				
Mean±SD	63.39±8.33	92.19±5.43	93.07±6.69	<0.001*
Median	63	92	93	
Range	48–73	88–97	89–103	
Lysholm score				
Mean±SD	64.16±6.77	94.12±5.09	95.73±3.79	<0.001*
Median	62	95	96	
Range	52–73	86–103	89–102	

SD: Standard deviation.

Table 4: Distribution of radiography at 1-year in the studied group:

	Studied group (*N*=21)
Radiography at 1-year, %	
Arthritic changes	1(4.8)
Patellar malalignment	2(9.5)

DISCUSSION

Patellar and patellofemoral joint abnormalities are common, and a significant percentage of patients who apply to orthopedic clinics have patellofemoral complaints. Among the more common patellofemoral issues include chondromalacia, degenerative arthritis, malt racking, and malposition issues [7]. Significant disability results from patellofemoral joint issues, either alone or in conjunction with tibiofemoral joint illnesses. With no loss of function, discomfort behind the patella is the most common sign of patellofemoral diseases. The pain mechanism and the patella's innervation remain unclear even though this is a prevalent clinical issue [8].

A significant number of nociceptive receptors can be destroyed by a head injury to the peripatellar soft tissue in the area next to the patella. Since the patellar tendon is a key point of entry for vessels that reach the patella and damage to these vessels may result in patellar necrosis, the area should not be included in this thermal lesion. For individuals with uncontrollable PFP who show no visible change, PD accomplished with this straightforward method may provide a remedy [6]. To assess the outcomes of PD in individuals with patellofemoral discomfort, this study used arthroscopy.

According to the study's findings, the average age of the patients was 31.9±8.12 years, their mean BMI was 24.38±2.83, 28.6% of them were men and 71.4% were women, and 38.1% of them had left-sided injuries while 61.9% had right-sided ones. According to El Sayed *et al.,* [9], the demographic data of the group under study showed that the age ranged from 23 to 48 years, with a mean age of 35.76±8.0 years. The group's mean weight was 23.7±3.11kg/m^2, with a range of 17 to 28.4kg/m^2. The group's sex distribution was seven (28.0%) male and 18 (72.0%) female. Eleven (44%) patients had a lesion on the left side, while 14 (56.0%) patients had one on the right.

Additionally, following malalignment correction, Singer and Halawa [10] assessed the impact of arthroscopic PD in patients with mixed tibiofemoral and patellofemoral OA. They looked at 45 patients (mean BMI: 25.15±3.04 kg/m^2; females/males, 27/18; age, 30–59 years, 45.5±8.50). 71.4% of patients in this study had grade 1 chondromalacia, 19.1% had grade 2, and 9.5% had no chondromalacia, according to arthroscopic findings. Flap tear MM, medial plica, MM horizontal tear, MFC chondromalacia G1, and MFC chondromalacia G2 were seen in an identical proportion (4.8%) of patients. Accordingly, El Sayed *et al.,* [9] discovered that 72% of cases had grade 1 chondromalacia and 20% had grade 2 chondromalacia. Additionally, they observed that one case had a flap tear in the posterior horn medial meniscus, another had medial plica, one had MFC chondromalacia grade 1, one had MFC chondromalacia grade 2, one had an MFC ulcer, and one had a medial meniscus horizontal tear. Twelve individuals revealed MRI evidence of patellar chondral injury, according to another study by Jain *et al.,* [11]. Three patients exhibited full-thickness cartilage abnormalities (grade 4), while twelve patients reported arthroscopic findings of grade 1 to 3 patellar chondromalacia.

According to this study, the VAS score for pain was significantly lower after 6 months (17.9±15.69) and after 12 months (15.3±14.69) than it was before surgery (81.4±5.04) (P<0.001). According to Altay *et al.,* [8], the denervation group had significantly better postoperative knee and function scores, ROM, patellar score, and VAS. These results suggest that, following total knee arthroplasty (TKA) without patellar resurfacing, electrocautery-assisted PD can reduce anterior knee pain and enhance clinical outcomes. PD can considerably enhance clinical outcomes for the first 12 months following TKA in relation to the incidence of AKP, the VAS, patellar score, KSS, and range-of-motion, according to another study by Xie *et al.,* [12]. Nevertheless, no difference was observed for any of the scores examined after the 12-month follow-up, indicating that the initial benefits of PD appear to wear off. Additionally, a prospective comparative study was carried out by Suwankomonkul *et al.,* [13] that involved the use of circumferential electrocautery for UKA plus PD. In patients with PFOA undergoing UKA, this study showed that PD reduces short-term anterior knee discomfort. When comparing anterior knee pain levels to those without denervation, even patients with high-grade full-thickness cartilage loss of the patella (grade III–IV) demonstrated a notable improvement.

Accordingly, Pongcharoen and Reutiwarangkoon [14] discovered that after a medial UKA , patients with medial OA knees, whether they had significant arthritis of the lateral aspect of the patella, had good clinical outcomes. Nonetheless, postoperative pain levels were lower for patients with full-thickness cartilage loss of the patella's lateral facet than for those without. When compared with individuals without patella denervation, these trials showed that extra patella electrocautery denervation for high-grade full-thickness cartilage loss of the patella (grade III–IV) significantly improves anterior knee pain scores. However, the two groups are identical in terms of revision rates, problems, and function.

Furthermore, even in patients with severe mono-compartmental arthritis (G III or IV) OA, Floerkemeier *et al.,* [15] reported positive results. Additionally, Bonasia *et al.,* [16] discovered that individuals with low-grade medial compartment arthritis had superior results. The current study found that Kujala scores increased statistically significantly throughout the follow-up. Similarly, El Sayed *et al.,* [9] stated that among the patients under study, a comparison of the preoperative and postoperative VAS scores showed a high statistically significant improvement in Kujala 6 months after surgery.

Additionally, compared with preoperative, Kujala showed a strong statistically significant improvement one year after surgery. After surgery, Kujala's score did not significantly alter at 6 months or a year later. Additionally, the Kujala score increased from 70.4 (45–84) before surgery to 93.3 (75–100) at 6 months, according to Jain *et al.,* [11]. In line with our research, Singer and Halawa [10] found that the Kujala score did not significantly alter at the final follow-up or 6 months after surgery, although it did improve at the final follow-up from 70.75 (range: 62–81) to 88.5 (range: 81–96). Additionally, Suwankomonkul *et al.,* [13] found that the Kujala score at 6 months was around 10 points higher than the score following UKA without PD.

In the present investigation, the Lysholm score increased statistically significantly throughout the follow-up. According to Zhao *et al.,* [17], the Kujala score increased from 68.34±6.22 to 76.48±6.54, and the Lysholm score improved from 73.29±4.48 to 80.93±4.21. For 10 to 24 months, they monitored 149 patients. El Sayed *et al.,* [9], on the other hand, did not observe any appreciable variations in the Lysholm score at 6 months or a year after surgery.

In the final follow-up, the postoperative Lysholm score increased from 63.5 (range, 56–71) to 90.5 (range, 86–95), according to another study by Singer and Halawa [10]. The Lysholm score improved in a very significant way. Both the Lysholm scores at the final follow-up and six months after surgery showed no discernible changes. Radiography results at 1-year follow-up in this study showed that two (9.5%) patients had patellar malalignment, and one (4.8%) patient had arthritis alterations. According to Insall *et al.,* [18], if patellofemoral congruence was restored, the outcomes were nearly invariably good or excellent. In contrast, no satisfactory results (as measured by either chronic discomfort or instability) were linked to the presence of surgical residual malalignment.

However, Wojtys *et al.,* [19] have demonstrated that although isolated lateral release often reduces discomfort, they have not demonstrated objective changes in malalignment following this technique. Fifteen (71.43%) patients had no surgical problems, four (19.05%) patients experienced quadriceps muscle atrophy, and two (9.52%) patients had hemarthrosis. Pulavarti *et al.,* [20] conducted evaluations at 3-, 12-, and 24-months following surgery in a similar vein. After PD, the incidence of AKP was significantly lower than that of nondenervation at 3 months, but not at 12 or 24 months. This suggests that the length of follow-up may have a major impact on the relationship between AKP incidence and PD.

At the 1-year follow-up, Goicoechea *et al.,* [21] also reported that the clinical examination and functional rating were carried out. It is therefore impossible to evaluate past results about the impact of PD in TKA with the resurfaced patella. According to a different study by Aderinto and Cobb [22], two (4%) knees experienced problems, both of which were superficial infections of the arthroscopic portal sites that were quickly healed following oral antibiotic treatment. The hematoma development reduction techniques outlined in this paper have proven successful. Deep vein thrombosis and postoperative hematoma did not occur in any of the patients in our series.

The complication occurrence rate, on the other hand, was 4% in the control group and 2% in the observation group, according to Qin *et al.,* [23]. This indicates that even when done in a very safe way, arthroscopic knee debridement and denervation therapy cannot raise or improve the complication occurrence rate.

LIMITATIONS

Small sample size of our patients. However, given the promising results of arthroscopic patellar neurectomy in patients with PFP, we recommend further multicenter studies in the future.

CONCLUSION

According to the clinical and radiological findings, arthroscopic PD offers a valuable option for patients with chronic, refractory PFP due to the above-mentioned pathologies, with the potential to significantly improve pain relief and quality of life.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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