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Case Report

Pulsed radiofrequency of iPACK (interspace between the popliteal artery and the posterior knee capsule) for pain control following meniscus repair - A case report

Romy Deviandri [a,b,*], M. Pramana KH [c], Viet Yuliana [d], D. Irawan [e]

[a] Department of Orthopedics, University of Groningen, University Medical Center Groningen, Groningen, the Netherlands
[b] Department of Physiology, Faculty of Medicine, Universitas Riau, Division of Orthopaedic, Arifin Achmad Hospital, Pekanbaru, Indonesia
[c] Department of Orthopaedic, Andalas University Hospital, Padang, Indonesia
[d] Department of Sport and Rehabilitation, Fit Centrum, Pekanbaru, Indonesia
[e] Department of Anesthesia, Arifin Achmad Hospital, Pekanbaru, Indonesia

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ABSTRACT

Adequate postoperative pain control is an essential factor for the success of rehabilitation programs after meniscus repair (MR). The pulsed radiofrequency of the interspace between the popliteal artery and the posterior knee capsule (PRF-iPACK) is a recently developed method. This study aimed to evaluate the use of PRF-iPACK in patients who underwent MR. We performed PRF-iPACK guided by ultrasonography for patients who underwent MR with aggravated pain. PRF-iPACK was performed following MR four weeks after surgery. The pain was evaluated using the visual analogue scale (VAS), Lysholm score, and the Euroqol-5 Dimension (EQ-5D).

In this study, two patients participated. For the results, a week and three months after treatment, the mean VAS score, Lysholm score, and EQ5D improved from 7 to 1 and 0 respectively, and 42 to 86 and 90 respectively, and 0.48 to 0.82 and 0.92 respectively.

We concluded that PRF-iPACK is an adequate and safe procedure for managing postoperative pain after MR. It may enhance the postoperative rehabilitation program.

Introduction

Meniscus tear is a common sports injury. The incidence of meniscal tears is approximately 60 per 100,000 population, and the incidence of meniscal-related injuries is rising significantly due to increased sports participation and advanced diagnostic tools [1]. Procedure of meniscus repair (MR) surgery is frequently performed by orthopaedic surgeons worldwide. It is estimated that approximately 17 procedures per 100,000 in the United States [1]. In Indonesia, the most populous country in Southeast Asia and the fourth globally, MR procedure increased more than 100 % each year from 2017 to 2020 based on data from the Indonesian National Health Insurance "BPJS" (Deviandri R, unpublished data).

Recently, MR techniques have advanced with various implants and techniques and deeper insight into meniscal biomechanics. MR could be performed via an open surgical or arthroscopic approach, and then arthroscopic MR can be achieved via inside-out, outside-in, and all-inside techniques [2,3]. Although the advancement of MR procedure emerged, pain remains the common postoperative

* Corresponding author at: Faculty of Medicine, Universitas Riau, Diponegoro street no 1, Pekanbaru 28133, Indonesia.
E-mail addresses: r.deviandri@rug.nl, romydeviandri@lecturer.unri.ac.id (R. Deviandri).

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complication that delays patient discharge and increases the costs associated with patient care [4–6].

Designing a successful plan to deliver sufficient pain relief is necessary since excellent postoperative pain management is associated with improved patient outcomes [5]. Narcotics, non-steroidal anti-inflammatory drugs (NSAIDs), and anaesthetics like lidocaine or bupivacaine with nerve blocking and regional anaesthetic capabilities are common substances in modern practice. Less frequently, ketamine, tranexamic acid (TXA), sedatives, gabapentinoids, and corticosteroids are prescribed [5,6].

Radiofrequency (RF) treatment is a medical procedure primarily used to alleviate pain [7]. With a low complication rate (less than 1 %), convenience of usage, and low cost, RF works by destructing a small nerve tissue area using the electric current produced by radio waves signal, then inhibiting or decreasing pain signals from a specific location [7]. It has been proven that knee pain can be effectively treated with pulsed radiofrequency (PRF) or by injecting iPACK (in the area between the popliteal artery and the posterior knee capsule) [8,9]. However, to the author's knowledge, no literature describes the use of PRF-iPACK for pain control following MR.

This study aims to evaluate the use of PRF-iPACK in patients who underwent MR and describe the role of PRF-iPACK in practice as a part of a multimodal regimen in pain management after MR.

Patient and method

In this prospective study, PRF-iPACK was performed four weeks after surgery on patients who underwent MR followed by aggravated pain. Three months follow-up was worked up. The study was conducted in 2023. The inclusion criteria were: male, 18 to 40 years old, the patient was diagnosed as having a meniscus tear in the posterior horn zone, and then who underwent MR with or without concomitant others meniscus procedure or concomitant anterior cruciate ligament reconstruction surgery, using outside-in or all inside technique by arthroscopy, complained of severe pain until four weeks after surgery, willingness to participate, and signing the informed consent form. The exclusion criteria had a multi-ligament injury involving multiple surgery procedures and using the addition of an analgesic drug besides the drug in this protocol (ketorolac 10 mg three times a day orally or diclofenac sodium 50 mg twice a day orally).

After consent, a Cosman RFG-4 RF device (from the United States) was used for the PRF-iPACK procedure. The patient is in a prone position. Using ultrasound (Wisonic Navi Colour Doppler; China), we locate the entry sites of the cannulas' insertion at the base of the posterior femoral condyles after putting the ground pad to the opposite side and cleaning the skin around the afflicted area. The popliteal artery, nerve, and posterior knee capsule are identified using a 12-MHz linear transducer. The posterior knee capsule is where the needle's tip should be placed. Following the determination of the entry site, 0.5 mL of 1 % lidocaine was used to numb the target point's skin and subcutaneous tissue. The long axis view of the ultrasound probe was used to insert the needle. Next, we target the posterior knee capsule percutaneously and introduce the cannulas with a 10-mm active tip (Fig. 1). Then, tests on the sensory and motoric functions were done. After proper placement, we injected 1 mL of 2 % lidocaine and then used an RF cannula to ablate the tissue. The pulsed RF is then administered for 3 min at 42 degrees Celsius. We then turn the cannulas 180 degrees, use the same settings for the following 3 min, and repeat the ablation. At the end of the procedure, we remove the cannulas and wrap the area with a bandage.

A single orthopaedic surgeon with experience in pain intervention guided by ultrasound (RD) carried out all treatments. During the course of the trial, patients were given additional analgesic medication (diclofenac sodium 50 mg twice a day) as needed. The Visual Analogue Scale (VAS) score was used to evaluate the patient's pain during the treatment and follow-up assessment up to three months. In addition, we also assessed the knee function using the Lysholm score and the quality of life using the Euroqol- 5 Dimension (EQ-5D) score.

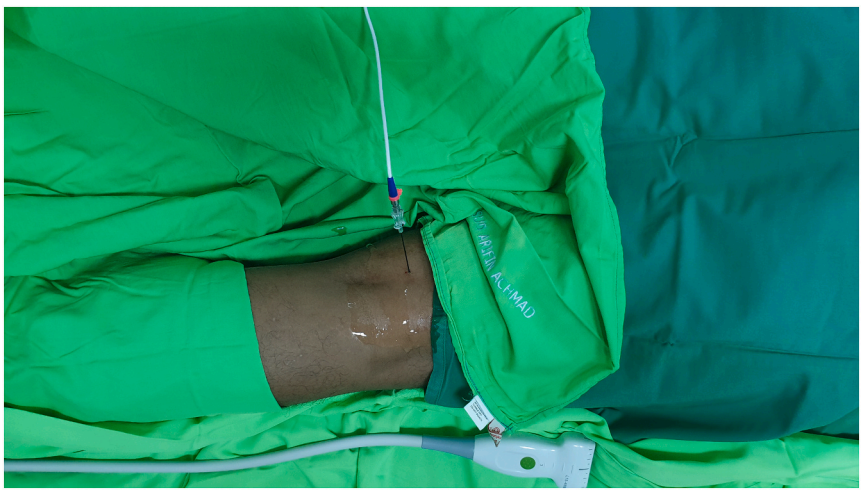

Fig. 1. i-PACK entry site at the base of posterior femoral condyle after identified using ultrasonography.

Results

Two patients participated in this present study and completed the informed consent form. The subject's characteristics are presented in Table 1. The mean age of participants was 20.5 years, with a Tegner level of 5.

The mean of the VAS pain score, the Lysholm score and EQ5D were presented in Table 2. After seven days and three months of follow-up, the mean VAS pain score improved from 7 to 1 and 0 subsequently, the Lysholm score improved from 42 to 86 and 90 subsequently, and the mean of EQ5D improved from o.48 to 0.82 and 0.92.

Discussion

This study aimed to evaluate the use of PRF-iPACK in patients who underwent MR. This study found that the mean VAS pain score after PRF-iPACK was decreased, and the mean Lysholm score and EQ5D were improved. These results concluded that PRF-iPACK is an adequate and safe procedure for managing postoperative pain after MR, and it may enhance the postoperative rehabilitation program.

It was known that treating knee discomfort with an RF and iPACK block would produce positive outcomes. Thoughts about osteoarthritis, post-total knee arthroplasty surgeries, and chronic knee discomfort have been raised by numerous investigations [8,9]. To individuals with knee pain-associated issues, the RF and iPACK block can provide significant clinical and functional improvements. The use of PRF to relieve knee pain following ACL reconstruction surgery has been mentioned in various research [10]. Recently, Tayfun Et et al. [11] found that iPACK block was also effective in knee pain after a knee arthroplasty procedure. In this study, we used PRF-iPACK on patients who had MR and experienced exacerbated pain, and we demonstrated that its efficacy in these circumstances was encouraging.

In a previous cadaveric study, it showed that iPACK anesthetizes the knee articular branches from the common peroneal nerve, tibial nerve and the posterior branch of the obturator nerve, with the exception of the nerve to vastus lateralis (NVL), the nerve to vastus medialis and the lateral branch of the nerve of vastus intermedius (NVI). The PRF-iPACK would have resulted in the blockade of the posterior knee articular nerve branch, thus has potentially ensured the analgesia effect to relieve the posterior knee pain [12,13].

The PRF-iPACK technique is simple and safe. According to Kim et al. (2016) [14], RF posed a risk of iatrogenic side effects, particularly vascular injury leading to the development of pseudoaneurysm, arteriovenous fistula, hemarthrosis, and osteonecrosis of the bone. However, in our research, we did not find this effect. The temperature is restricted to 42 degrees Celsius when using pulsed PRF-IPACK to ensure no tissue damage happens. It might explain why there were no negative effects in our investigation. Since the procedure is still in its infancy, nothing is known regarding its long-term efficacy and side effects. More research is required to evaluate this treatment over a longer time.

The current study has some limitations, including a sample size that is insufficient, the fact that it was conducted only in one centre, and the absence of comparisons with alternative therapies, including femoral nerve blocks or adductor canal blocks, which are more commonly used to manage postoperative pain following knee surgery. In order to compare the results with different methodologies, the authors suggest doing multi-centre prospective studies with large sample numbers in the future.

Conclusions: PRF-iPACK is an adequate and safe procedure for managing postoperative pain after MR. It may enhance the postoperative rehabilitation program.

CRediT authorship contribution statement

Romy Deviandri: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration,

Table 1
Demographic patient characteristics (N = 2).

Characteristic	Value
Age (y), mean ± SD	20.5 ± 1.5
Diagnosed	
Meniscus tear posterior horn	2 (100 %)
Treatment	
Repair all-inside	2 (100 %)
Affected side, n (%)	
Right	1 (50 %)
Left	1 (50 %)
Tegner level	5
Occupation, n (%)	
Athlete	0 (0)
Non-athlete	2 (100 %)
Activity at injury, n (%)	
ADL	0
Sport	2 (100 %)
Traffic	0
Work	0

Abbreviations: y, years; ADL, activity of daily living; SD, standard deviation.

Table 2
The mean of VAS pain scores and EQ5D pre and post-treatment.

	Before treatment	After treatment
The mean of VAS	7	1
The mean of Lysholm	42	86
The mean of EQ5D	0.48	0.82

Abbreviations: VAS, visual analogue scale; EQ5D, Euroqol-5 Dimension; ADL.

Resources, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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