COMPARATIVE STUDY BETWEEN KNEE GENICULAR NERVE ABLATION BY THERMAL RADIOFREQUENCY VS THERMAL RADIOFREQUENCY PLUS ALCOHOL NEUROLYSIS FOR TREATMENT OF SYMPTOMATIC KNEE OSTEOARTHRITIS

Paula M. elkomos, Lydia E. Zakhary and Samuel H. Daniel

Departement of Anesthesia and Intensive Care unit, Faculty of Medicine, Ain Shams University, Cairo, Egypt.

Corresponding author:
Lydia E. Zakhary
Mobile: +201222555128
E-mail:
Lydia_zakhary@med.asu.edu.eg

Received: 3/9/2023
Accepted: 20/10/2023

Online ISSN:

ABSTRACT:

Background: *Radiofrequency ablation of the genicular nerves has become accepted as a considerable technique to decrease the knee pain in advanced osteoarthritis. Recently chemical neurolysis has shown a cheap, safe alternative and may be with less failure rate because it covers the anatomical variation of the courses of the nerves. However, no one studied the combination of both of them as regarding the efficacy and the duration of pain relief and whether there is adding benefit or not.*

***Aim of the Work*:** *The aim of our study is to compare effectiveness (satisfaction) and duration of pain relief between patients who undergo the conventional thermal radiofrequency on the genicular nerves alone vs patients who undergo the conventional method plus alcohol neurolysis of the targeted nerves.*

Patients and Methods: *A total of 52 elderly patients, aged 60 to 70 years old, ASA I, II, III, with knee osteoarthritis, were included in the trial. They were divided into two groups (26 patients each). One group receiving genicular nerve ablation using radiofrequency alone, the other group receiving thermal radiofrequency ablation with alcohol neurolysis.*

Results: *the group receiving genicular nerve ablation using radiofrequency with alcohol neurolysis. Showed significant analgesia after 1 month and 6 months.*

Conclusion : *Adding chemical neurolysis to the radiofrequency ablation of the genicular nerves helps in hunting those nerves, decrease the dis-satisfaction and helps in increasing the duration of pain relief.*

Keywords : *eldery, knee oesteoarthitis, pain, radiofrequency, numeric pain score scale. alcohol neurolysis*

INTRODUCTION:

Knee osteoarthritis is a common disease mostly affecting the old, aged people causing severe pain while using the joint and hence a number of methods have been used to decrease the pain and help the patients to maintain a normal quality of life [(1)].

Genicular nerve ablation is a known procedure to help these cases as they transfer the pain signal of the knee. It is usually reserved for patients with symptomatic knee osteoarthritis who have had failure of conservative treatment and have had failure of or are poor candidates for surgery [(2)].

However, there is a high failure rate among the patients undergoing the procedure as regarding the efficacy or the duration of pain relief and various methods have been

used to increase the rate of success and the duration of the pain relief such as using alcohol in the ablation, cooled radiofrequency or increase the lesions on the nerves [3&4].

Das et al 2019 studied the efficacy and safety of alcohol neurolysis of genicular nerve [4].

The idea of the conventional radiofrequency is to perform a lesion of the 3 sensory nerves primarily responsible for transmitting knee pain from the arthritic joint to the central nervous system. In this procedure, heating occurs from an intense alternating electrical field at the tip of the radiofrequency cannula, which produces enough heat to denature the proteins in the target nerve. The accepted heating parameters for this procedure are 70° to 80°C for 60 or 90 seconds on each nerve [5&6].

AIM OF THE WORK:

The aim of our study is to compare effectiveness (satisfaction) and duration of pain relief between patients who undergo the conventional thermal radiofrequency on the genicular nerves alone vs patients who undergo the conventional method plus alcohol neurolysis of the targeted nerves.

PATIENTS AND METHODS:

a) *Study design*: That was a double blinded controlled clinical trial
b) *Study period*: 6 months
c) *Study place:* Conducted at Ain Shams University hospitals
d) *Study population:* 52 Patients with symptomatic knee osteoarthritis. Were included in this study.
e) *Sample Size calculation:*

By using Power Analysis and Sample Size Software (PASS 15) (Version 15.0.10) for sample size calculation, setting power at 80%, at significance level 0.05, and after assuming that there is large effect size difference (d = 0.8) in the mean of duration of pain relief in patients with symptomatic knee osteoarthritis undergoing knee genicular nerve ablation between those with thermal radiofrequency only and those with thermal radiofrequency plus alcohol neurolysis, based on that, a sample size of at least 52 patients with symptomatic knee osteoarthritis divided into 2 groups (26 patients in each group) will be sufficient to achieve study objectives.

Inclusion criteria:

1- Both genders.
2- Age between 60-70 years.
3- ASA I, II, and III physical status.
4- X ray imaging confirming the osteoarthritis and unwell or not candidate for knee replacement surgery

Exclusion criteria:

1- Neurological disorders. (Previous cerebrovascular stroke, neuropathy, or weakness)
2- Coagulopathy (plt < 50000, INR > 1.7)
3- Infection at or near the injection site.
4- Presence of pacemaker or defibrillator
5 - Acute knee injury.
6- Age < 60 or >70 years

Ethical consideration:

Approvals of anesthesia and intensive care department and the ethics committee, faculty of medicine, Ain Shams University were obtained. We obtained informed consent from all patients prior to initiation of the study.

f) *Study procedure:*

After approval of ethical committee of Ain shams University hospitals,

Patients meeting the inclusion criteria were randomly assigned into two groups, the control group and the study group, by a computer-generated randomization program. All patients in both groups were informed by the study methods, aim, side effect in clear language, written consent will be taken in clear spoken and written language.

The patients are placed in supine position with knee preparation using an iodine-based product and drape in a sterile manner.

Then the ground pad of the radiofrequency machine was placed in the other leg (we used the Neurotherm NT1100 regenerator)

All the patients were monitored by ECG, non-invasive blood pressure and pulse oximetry.

The 3 entry sites were detected under fluoroscopy then local anesthesia was performed using lidocaine 2% followed by the insertion of the 3 radiofrequency cannulas (STRYKER 20 G, 9 cm with 1 cm active tip) targeting the 3 main nerves (superior medial genicular, superior lateral genicular and the inferior medial genicular nerves) [(7)].

A confirmation of the targeted sites was done under fluoroscopy in both A-P and lateral views then a motor stimulation was done to ensure no undesirable motor response followed by lidocaine 1 % injection and placing of the radiofrequency cables and ablation was done at 80 degrees for 90 seconds.

The procedure was repeated 3 times at different levels in the lateral view separated by 0,5 cm to ensure successful targeting. Then remove the needles.

The control group received radio-frequency alone which is the standard in this situation.

The 2nd group passed through all steps but after the radiofrequency was done at each level a 1 ml of 70% alcohol was injected making a total of 3 ml injection to each nerve. As described by Dass et al 2019[(4)]

Randomization was done and then the random numbers were kept in a numbered sequentially sealed envelopes & opened by the attending physician. The drugs were prepared in identical syringes by a physician not involved in data collection.

Outcome Measurements:

The present study employed the numeric pain score scale scores (0-10, with 0 indicating no pain and 10 indicating the worst pain possible) to evaluate the analgesic effect during and after the procedure. The pain scores were recorded before the procedure, after 1 month and after 6 months.

Data collection:

Demographic and clinical data were extracted from the medical records (age, sex, pain duration, and a baseline average pain NRS). Each patient was asked to assess their symptoms at 1 and 6 months after the procedure.

Statistical Analysis:

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges. The comparison between two groups with quantitative data and non-parametric distribution were done by using Mann-Whitney test. Also, the comparison between pre, 1 month and 6 months in each group was done using Friedman test followed by post hoc analysis using Wilcoxon Rank test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant at the level of <0.05.

RESULTS:

There were no significant differences between the demographic data in both groups as regarding age or sex or weight.

Table (1): Comparison between numeric pain scores of RF alone and RF + alcohol at baseline, after 1 month and 6 months and regarding amount of change at different times

		RF alone No. = 26	RF+ alcohol No. = 26	Test value	P-value	Sig.
Pre	Mean ± SD	7.27 ± 0.64	7.29 ± 0.59	-0.010‡	0.992	NS
	Range	6 – 8	6 – 8			
1 month	Mean ± SD	3.81 ± 1.27	3.15 ± 1.01	-2.030‡	0.042	S
	Range	1 – 7	1 – 5			
6 months	Mean ± SD	5.08 ± 1.76	3.88 ± 1.18	-2.364‡	0.018	S
	Range	2 – 8	1 – 6			
Amount of change between Pre and 1 month	Mean ± SD	-3.46 ± 1.33	-4.13 ± 1.20	-1.878‡	0.060	NS
	Range	-6 – 0	-6.5 – -2			
Amount of change between pre and 6 months	Mean ± SD	-2.19 ± 1.79	-3.40 ± 1.32	-2.422‡	0.015	S
	Range	-5.5 – 0	-6.5 – 0			
Amount of change between 1 and 6 months	Mean ± SD	1.27 ± 1.40	0.73 ± 1.12	-1.330‡	0.184	NS
	Range	0 – 4	-1 – 3			

P>0.05: Non-significant (NS); P <0.05: Significant (S); P <0.01: Highly significant (HS)‡: Mann-Whitney test

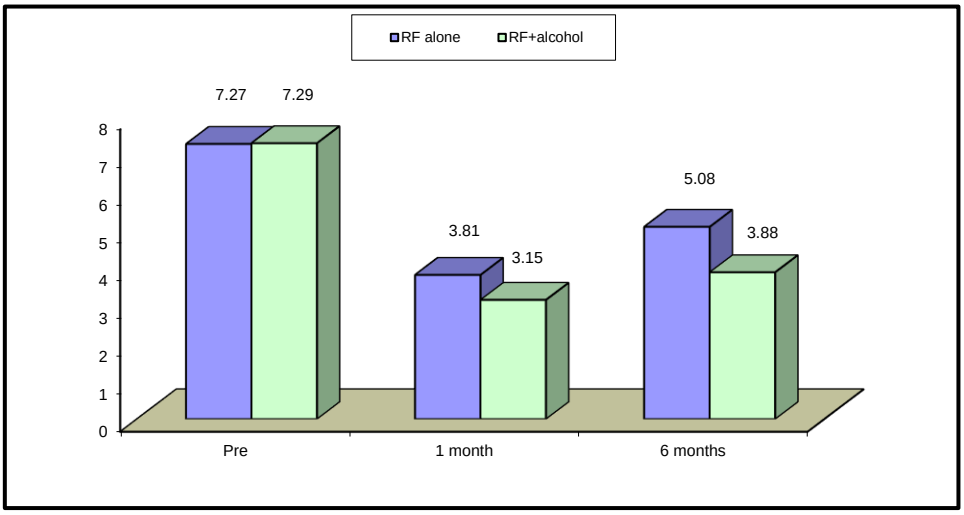

Diagram (1): pain alteration after 1 month and 6 months between 2 groups

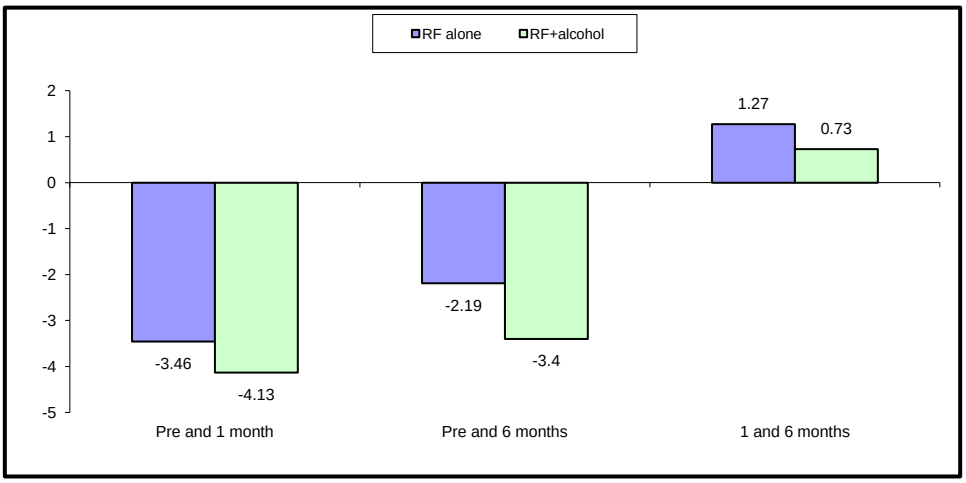

Diagram (2): Amount of change of pain perception between timings

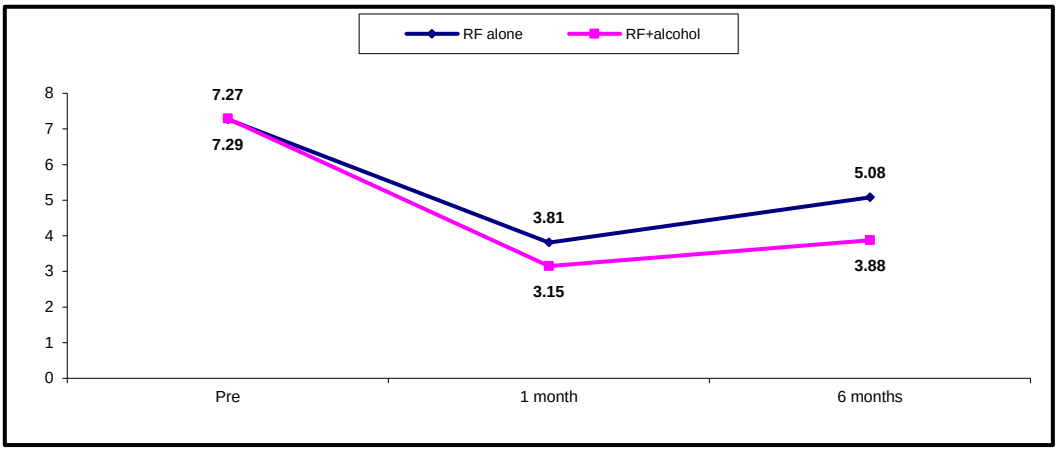

Diagram (3): Pain score scale after 1 month and 6 months

DISCUSSION:

The 3 lesions of the 3 main nerves are a common practice in our institute to increase the chance of the lesioning (although some studies were done by targeting more nerves) and the only difference between both groups is the addition of 1 ml alcohol 70% after each lesion. All the patients in both groups have some degree of improvement even if for a short period with no complete failure.

The main question we asked the patients was how you estimate the pain before and after the procedure according to the numeric pain score from 0 to 10 which was repeated at 1 month and at 6 months after as, no improvement usually expected in the first few weeks due to some degree of neuritis and pain from the needle injury and manipulations.

The results showed significant pain relief while adding alcohol at 1 month and more significant at 6 months, some papers showed nearly same effect with only alcohol neurolysis without radiofrequency. In our opinion is that the main problem is missing the nerves or do insufficient lesion considering the anatomical variations in the courses of these nerves so, we considered that adding alcohol will augment the effect and help in the neural capture which helped in the better results.

Both groups showed regression in the pain relief during the 6 months period as the procedure usually is short acting as the nerves eventually grows back especially in the late stages of osteoarthritis with continuous friction of the joints however this was also less obvious in the 2nd group as the relief was more solid and the NPS didn't changes easily.

While most of the patients were satisfied in both groups at 6 months but the 2nd group patients showed more appreciation and were less irritable about the future, of course this is not in our measures in our study but was noticed.

No side effects were detected in all the patients of this study.

Conclusion:

Adding chemical neurolysis to the radiofrequency ablation of the genicular nerves helps in hunting those nerves, decrease the dis-satisfaction and helps in increasing the duration of pain relief.

Limitations:

A limitation in the current study, is using only the pain score scale , not associated with a validated functional outcome measurement specific to the knee like the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) .

Conflict of interest:

No potential conflict of interest related to this article.

REFERENCES:

1. **Lundgren-Nilsson Å, Dencker A, Palstam A, Person G, Horton MC, Escorpizo R, Küçükdeveci AA, Kutlay S, Elhan AH, Stucki G, Tennant A, Conaghan PG**. Patient-reported outcome measures in osteo-arthritis: a systematic search and review of their use and psychometric properties. RMD Open. 2018;4(2).
2. **Vasco Deon Kidd, DHSc, MPH, MS, PA-C,1 Scott R. Strum, MD,1 David S. Strum, BA,2 and Jayprakash Shah, MD** Genicular Nerve Radiofrequency Ablation for Painful Knee Arthritis: The Why and the How. JBJS Essent Surg Tech. 2019 Mar 26; 9(1): 1-7.
3. **Wehling P, Evans C, Wehling J, Maixner W**. Effectiveness of intra-articular therapies in osteoarthritis: a literature review. Ther Adv Musculoskelet Dis. 2017. August;9(8): 183-96. Epub 2017 Jun 20.
4. **Rushin Maria Dass,1,2 Eunsoo Kim,1,3 Hae-kyu Kim,1 Ji Youn Lee,1 Hyun Ju Lee,1 and Seung Joon Rhee 4** Alcohol neurolysis of genicular nerve for chronic knee pain Korean J Pain. 2019 Jul; 32(3): 223–227. Published online 2019 Jul 1. doi: 10.3344/kjp.2019.32.3.223.
5. **Iannaccone F, Dixon S, Kaufman A.**: A review of long-term pain relief after genicular nerve radiofrequency ablation in chronic knee osteoarthritis. Pain Physician 2017. March;20(3): E437-E444.
6. **Woo-Jong Choi 1, Seung-Jun Hwang, Jun-Gol Song, Jeong-Gil Leem, Yong-Up Kang, Pyong-Hwan Park, Jin-Woo Shin** Radiofrequency treatment relieves chronic knee osteoarthritis pain: a double-blind randomized controlled trial. 2011 Mar;152(3):481-487.

   doi: 10.1016/j.pain.2010.09.029. Epub 2010 Nov 4.
7. **Jian Liu , Ting Wang , Zhen-Hua Zhu** Efficacy and safety of radiofrequency treatment for improving knee pain and function in knee osteoarthritis: a meta-analysis of randomized controlled trials. Orthop Surg Res 2022 Jan 15;17(1):21. doi: 10.1186/s13018-021-02906-4.

دراسة مقارنة بين استئصال العصب الجيني للركبة بالترددات الحرارية مقابل الترددات الحرارية بالإضافة إلى التحلل العصبي الكحولي لعلاج التهاب مفاصل الركبة المسبب للأعراض

بولا ميشيل القمص، ليديا ادوارد زخاري، صموئيل حبشي دانيال

قسم التخدير و الرعايه المركزه و علاج الالم - كلية الطب جامعة عين شمس

المقدمة: أصبح الاستئصال بالترددات الراديوية للأعصاب الجينية مقبولاً كأسلوب مهم لتقليل آلام الركبة في حالات هشاشة العظام المتقدمة. لقد أظهر التحليل العصبي الكيميائي مؤخرًا بديلاً رخيصًا وآمنًا وقد يكون بمعدل فشل أقل لأنه يغطي الاختلاف التشريحي في مسارات الأعصاب. لكن لم يدرس أحد الجمع بينهما من حيث فعالية ومدة تخفيف الألم وهل هناك فائدة إضافية أم لا.

الهدف من الدراسه: هو مقارنة فعالية (الرضا) ومدة تخفيف الألم بين المرضى الذين يقومون بإجراء الترددات الراديوية الحرارية التقليدية على الأعصاب الجينية وحدها مقابل المرضى الذين يقومون بالطريقة التقليدية بالإضافة إلى التحلل العصبي الكحولي للأعصاب المستهدفة.

المرضي والطرق : سيكون 52 مشاركًا ، وسيتلقى 26 منهم **استئصال العصب الجيني للركبة الترددات الحرارية بالإضافة إلى التحلل العصبي الكحولي** و 26 اخرين سيتلقوا الترددات الحراريه فقط .

النتائج : تبين وجود تباين احصائي في تقليل آلام الركبه لدى مرضى المسنين الذين يعانون من التهاب المفاصل المسبب للاعراض في المجموعه المتلقيه التردد الحراري بالاضافه الي التحلل العصبي الكحولي

الخاتمه : استئصال العصب الجيني للركبة الترددات الحرارية بالإضافة إلى التحلل العصبي الكحولي يسكن الام الركبه من التهاب المفاصل بصوره اقوي من التردد الحراري فقط.