MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.8.380.384

OPEN ACCESS

Key Words
Knee oa, genicular nerves, USG, NRS, womac score

Corresponding Author
Ramesh Gajula,
Department of Anaesthesia, Panacea Spine Pain Ortho Sleep Centre, Uppal, Hyderabad, India
bethi.ravi@gmail.com

Author Designation
[1,2,3]Resarch Fellow
[4]Consultant

Received: 8 June 2024
Accepted: 22 July 2024
Published: 26 July 2024

Citation: Ravinder Bethi, Kone Rekha, Deepika and Ramesh Gajula, 2024. Ultrasound Guided Cooled Radiofrequency Ablation of Genicular Nerves of Knee for Relief of Intractable Pain From Medial Compartment Osteoathritis Under Spinal Anesthesia. Res. J. Med. Sci., 18: 380-384, doi: 10.36478/ makrjms.2024.8.380.384

Ultrasound Guided Cooled Radiofrequency Ablation of Genicular Nerves of Knee for Relief of Intractable Pain From Medial Compartment Osteoathritis Under Spinal Anesthesia

[1]Ravinder Bethi, [2]Kone Rekha, [3]Deepika and [4]Ramesh Gajula
[1-4]Department of Anaesthesia, Panacea Spine Pain Ortho Sleep Centre, Uppal, Hyderabad, India

Abstract
The primary objective of this observational study was to evaluate that there is no motor palsy of leg after the procedure in subjects undergoing cooled radiofrequency ablation of genicular nerves of knee in whom there is intractable pain due to medial compartment osteoarthritis under spinal anesthesia .Avoid excessive pain to patient during needling, avoid discomfort to patient during the procedure of cooled radiofrequency ablation by avoiding motor stimulation and elicitation of paresthesia. To evaluate the long-term outcomes of cooled radiofrequency ablation (CRFA) of superior medial and inferior medial genicular nerves for treatment of chronic knee pain due to medial compartment osteoarthritis. To evaluate the efficacy and safety of CRFA of genicular nerves of medial compartment of knee under spinal anesthesia. The ultrasound guided radiofrequency ablation of superior medial and inferior medial genicular nerves of knee joint was done in patients with grade 3 and grade 4 osteoarthritis of medial compartment of knee, with intractable pain (Numerical Rating Scale >7). who had failed conservative management and intra articular injections after a positive genicular nerve block with local anesthetics. The demographics, pain intensity measured in NRS, Oxford knee score, WOMAC score was measure at baseline and after the procedure. Ultrasound guided radiofrequency ablation of genicular nerves of medial compartment of knee joint under spinal anesthesia is a good alternative option for patient who are having severe pain and disability from medial compartment osteoarthritis. No motor palsy observed in subjects post procedure, has good relief of pain and has high efficacy and safety to do the procedure under spinal anesthesia.

INTRODUCTION

OA of knee joint is one of the most common disease conditions with advanced age and leads to considerable morbidity in terms of pain, stiffness, limitation in function. Knee OA has substantially increased in prevalence in developed nations since the postindustrial era: longer life expectancy, increased BMI, and other independent variables have been implicated in this rise in prevalence. Generally, the treatment goals for knee OA include improving patient function and alleviating pain[1-3].

Initially to start with conservative therapy like physical therapy, non-steroidal anti-inflammatory medication and intra articular corticosteroid injections are available. Surgical intervention with total knee arthroplasty (TKR) is an excellent option to improve patient function and relieve pain.

For these types of patients, there are other non-surgical interventions are accessible, which includes intra articular steroid or hyaluronic acid or PRP, botulinum toxin, acupuncture, periosteal stimulation therapy, balneotherapy / spa therapy, biomedical interventions (knee braces, knee sleeves and foot orthoses), cane (walking stick), crutches, electrotherapy /neuromuscular electrical stimulation, exercise (land and water-based strength training and weight management, etc.

Few options exist for patients who fail initial conservative treatment options and desire to postpone TKR or for those who are poor surgical candidates. Cooled radiofrequency ablation of genicular nerve of knee has been introduced as a safety, minimally invasive alternative for these patients.

This procedure is performed using a thermal probe that is directed using Fluoroscopy or USG to visualize described and validated bony markers in the path of the genicular nerves. The current is applied through the probe to induce a thermal injury to the targeted nerve, which in turn disrupts the neuro signaling of pain sensation from the knee capsule. The patients initially undergo a diagnostic genicular nerve block with local anesthesia. If the nerve block is successful in alleviating the patient's pain, cooled radiofrequency ablation is performed of superior medial, inferior medial genicular nerves[4,5].

Ablation of inferior lateral genicular nerve is frequently avoided because of their close proximity to the common peroneal nerve. Cooled radiofrequency ablation if genicular nerve has been shown to be effective in reducing pain in knee OA up to 6 months. CRFA has been shown to provide at least 12 months relief for painful conditions of spine and has recently emerged as a minimally invasive option for pain control in patient with OA of knee[6-8].

In our observational study, we had done radiofrequency ablation of superior medial and inferior medial genicular nerves under spinal anesthesia under ultrasound guidance in 40 patients with severe pain from advanced medial compartment OA knee after positive diagnostic genicular blocks.

MATERIALS AND METHODS

After institutional review board approval was obtained (), consecutive patients treated between Jan 2022-Jan 2023. patients were included in the study if the following criteria were met:

Inclusion Criteria:

- Age 35-80yrs
- Native symptomatic knee (especially medial compartment)
- 50% or more concordance pain during walking and weight bearing following a diagnostic block of genicular nerves of medial compartment with 1 ml of 2% lignocaine.
- Patient diagnosed with medial compartment knee OA.
- Grade 3 and 4 OA knee.

Exclusion Criteria: The exclusion criteria for the study were as follows:

- Patients underwent knee arthroplasty or arthroscopic surgery.
- Patients provided insufficient data.
- Age <35yrs.
- OA of lateral compartment of knee or patellofemoral component of knee.
- No associated medical co-morbidities.

The procedure was performed only after obtaining a written informed consent for the procedure, the potential benefits and the risks associated with the procedure, such as anesthesia dolorosa, differentiation pain and motor weakness.

Diagnostic Medical Geniclular Nerve Block: All patients were given diagnostic genicular block in the operation theatre under all aseptic conditions. Monitoring was done as per ASA standards and IV cannulation was also done.

Patients were made to sit and under sterile aseptic precautions spinal anesthesia given in L3-L4 Intervertebral space using 25G QB spinal needle, after free flow of CSF seen drug 0.5% Bupivacaine (H) 2cc(10mg) instilled intrathecally and after the level of T12 blockade was achieved, the patients are positioned in supine on the OT table.

The affected knee joint is cleaned with antiseptic solutions and covered with sterile drapes. the genicular nerves visualized with the help of high frequency (6-13

HZ) linear USG probe, M-turbo ultrasound system., Sono site USG machine. A systemic scan was done on the superior, inferior and medial aspects of the knee joint and genicular nerves were identified in the following way.

Superiomedial Genicular Nerve (SMGN): SMGN arises from nerve to vastus medialis which itself is a branch of femoral nerve. To visualize MSGN, the ipsilateral hip was externally rotated to position the medial aspect of knee joint facing superiorly and the USG transducer was aligned transversely over the medial aspect of the knee joint and moved proximally to the level of adductor tubercle and insertion of adductor tendon. The target area was just proximal and anterior to the adductor tubercle, where genicular nerve and vessels were found to be lying together. the needle was directed from anterior to posterior in the in-plane approach towards the nerve.

Inferiomeidal Genicular Nerve (IMGN): IMGN is derived from infra patellar branch of saphenous nerve and runs in close proximity to inferior medial genicular artery in the junction between tibial condyle and shaft. To visualize the IMGN, the hip was externally rotated and knee if flexed. The USG transducer is aligned along the short axis of the tibia and medial collateral ligament. The needle was initiated in the in-plane approach from the anterior to the posterior direction towards the IMGN and artery, both of which lie just underneath the medial collateral ligament.

A 22G, 50 cm son plex slim cannula was directed towards the genicular nerves under USG. No elicitation of paresthesia along the area of the knee joint supplied, no motor stimulation was done.

A 5 cm long straight CRF cannula with 6 cm active tip was advanced under USG guidance towards the nerve.

The final position of the tip of the RF needle was close to the nerve for each genicular nerve, two CRF lesions were done for 2 min 30 sec at 60 F temperature.

The patients were observed for 6 hours, immediately after the procedure for any immediate complications and relief of pain, motor palsy of the leg as we are not performing elicitation of paresthesia and motor stimulation of the nerves during procedure.

RESULTS AND DISCUSSIONS

Demographic: The average age of the patients was years and out of them half of them were males and half were female patients. The patients were having with grade 3 and grade 4 of Kellgren and Lawrence system of medial compartment osteoarthritis of knee.

Previous Treatment History: All patients had previously undergone conservative treatment and intra articular injections of steroids, hyaluronic acid, platelet rich plasma and so on.

Pain Intensity: The radiofrequency treatment resulted in significant improvement in the pain intensity at rest, on movement and on walking up to 6 months. After the procedure almost all patients had >50% improvement in pain intensity at rest, on movement and on walking.

The OKS had improved significantly from before the procedure to after the procedure and this improvement was maintained in further follow ups.

Total number of patients 40, number of patients with NRS score < 50% after the procedure is 29% of the patients WHOT GOT>50% of pain relief 72.5(29/40)

Knee pain from OA is an increasing problem encountered by orthopedic surgeons. However, many patients are unable to find relief with conservative management and are not suitable candidates for knee replacement surgery, because of other associated co-morbid medical conditions[9-11].

The ability of RFA to reduce pain and improve function in patients with OA knee has been well established in many studies[12-13].

Genicular nerve CRFA offers a less invasive option that has been shown to be effective in treating OA knee pain for up to 6 months or longer.

CRFA is a safe treatment modality that can be performed to treat a variety of conditions. A large proportion of the patients undergoing diagnostic genicular nerve block failed to gain greater than 50% pain relief from the procedure.

Patients with self-reported psychological co -morbidities, smoking history and Diabetes mellitus were significantly more likely to fail genicular nerve block. This states that the failures are less likely because of technical factors, but rather patient specific peripheral and central pain processing.

There are many interventions for knee pain described in the literature for patients with severe

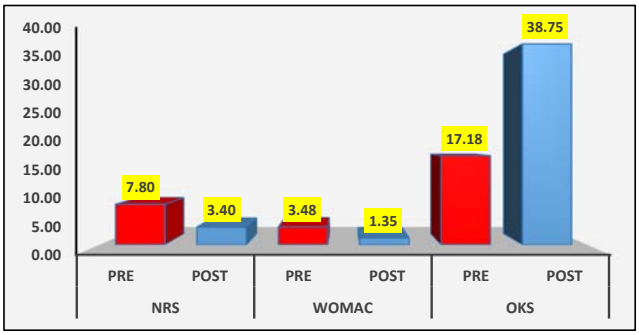

Fig. 1: Mean NRS, WOMAC and OKS distribution

Table 1: NRS, WOMAC and OKS mean distribution before and after procedure The pain , stiffness and physical function as measured by WOMAC score improved significantly from before the procedure to after the procedure

		Mean	N	Std. Deviation	"t " Test	p-value
NRS	PRE	7.8	40	0.9392	37.393	0.000<0.001
	POST	3.4	40	0.4961		
WOMAC	PRE	3.48	40	0.5057	22.137	0.000<0.001
	POST	1.35	40	0.483		
OKS	PRE	17.18	40	1.3754	63.911	0.000<0.001
	POST	38.75	40	1.5317		

knee pain who either cannot undergo surgery or not willing to undergo surgery. but most of these interventions are not effective in all the patients[14-16].

In our study, the immediate pain relief was excellent with >50% relief in nearly all patients at rest, on movement and on walking. we observed that there is no discomfort to the patient during the procedure because of ablation of nerves.

In our study we did not perform elicitation of paresthesia and motor stimulation of the genicular nerve, as we have done the procedure under spinal anesthesia.

The underlying mechanism of analgesics effects behind CRFA technology is thought to be that it creates a thermal lesion in sensory nerve by channeling focused energy and causing sustained temperature in excess of 80 C, peripheral sensory nerve regeneration rates following injury (such as thermal ablation are well documented).

Post procedure motor palsy is not seen even in single patient. As described by Rojhani *et al.,* the use of COOLIEF cooled radiofrequency allows greater energy to be applied due to the water-cooling mechanism, which minimizes temperature at the probe tip and facilitates the creation of a larger lesion[16-17].

The lesions may offer more efficient and longer periods of analgesia by enabling more accurate targeting of culprit nerves and required longer duration of nerve healing, respectively.

HO *et al.* previously suggested that CRFA can provide analgesic effects for 24 months when used to treat painful sacroiliac joints, and data from this series continuous to support that concept[8-19].

No patient complained of transit pain during the RFA which had earlier occurred during fluoroscopic guided RFA and was attributed to the stimulation of the periosteum and ligament insertion site by RF cannula. In USG guidance, the precise position of the RF cannula could be visualized, thus avoiding the injury to the nearby structures.

CONCLUSION

In this subset of subjects from an observational study, COOLEF of SMGN and IMGN ablation under spinal anesthesia was safe, provided sustained pain relief, improved function, no motor palsy of leg was seen after the procedure in patients with chronic medial compartment OA knee joint pain. CRFA is an effective adjuvant therapy as a part of a multimodal pain regions for many patients with OA of knee joint.

REFERENCES

1. Wallace, i.j., S. Worthingtone and D.T. Felson,et al., 2017. Knee osteoarthritis has doubled in prevalence since the mid -20th century. Prof Natl Acad Sci., Vol. 14, No. 35.
2. Ayhan, E., H. Kesmezacar and I. Akgun, 2014. Intraarticular injections (corticosteroid, hyaluronic acid, platelet rich plasma) for the knee osteoarthritis. World J. Orthop., 5: 351-360.
3. Jüni, P., R. Hari, A.W. Rutjes, R. Fischer and M.G. Silletta,et al., 2015. Intra-articular corticosteroid for knee osteoarthritis. Coch Data Syst. Rev., Vol. 2015, No. 10 .10.1002/14651858.cd005328.pub3.
4. Weiner, D.K., T.E. Rudy and N. Morone,et al., 2007. Efficacy of periosteal stimulation therapy for the treatment of osteoarthritis -associated chronic knee pain: an initial controlled clinical trial. F Am Ger Soc., 55: 1541-1547.
5. White, A., N.E. Foster, M. Cummings and P. Barlas, 2007. Acupuncture treatment for chronic knee pain: A systematic review. Rheumatology, 46: 384-390.
6. Brown, G.A., 2013. AAOS Clinical practice guidelines treatment of osteoarthritis of the knee: evidence-based guideline, 2nd edition. J Am Acad orthop surg., Vol. 21, No. 9.
7. Paxton, E.W., R.S. Namba, G.B. Maletis, M. Khatod and E.J. Yue et al., 2010. A prospective study of 80, 000 total joint and 5000 anterior cruciate ligament reconstruction procedures in a community-based registry in the united states. J. Bone Joint Surg., Vol. 92, No. 2 .10.2106/jbjs.j.00807.
8. Kim, S.Y., P.U. Le, B. Kosharsyy, A.D. Kaye and N. Shaparin,et al., 2016. Is genicular nerve radiofrequency ablation safe? A literature review and anatomical study pain physician. Vol. 19, No. 5.
9. Patel, N., 2016. Twelve -month follow up of a randomized trial assessing cooled radiofrequency denervation as a treatment for sacroiliac region pain. Pain Pract., 16: 154-167.
10. Stelzer, W., M. Aiglesberger, D. Stelzer and V. Stelzer, 2013. Use if cooled radiofrequency lateral neurotomy for the treatment of sacroiliac joint -mediated low back pain: a large case series. pain Med., 14: 29-35.
11. Pineda, M.M.S., L.E. Vanlinthout, A.M. Martín, J. van Zundert, F.R. Huertas and J.P.N. Ruiz, 2017. Analgesic effect and functional improvement

caused by radiofrequency treatment of genicular nerves in patients with advanced osteoarthritis of the knee until 1 year following treatment. Reg Ane Pain Med., 42: 62-68.
12. Davis, T., E. Loudermilk and M. Depalma,et al., 2018. Prospective, multi -center, randomized cross over clinical trial comparing the safety and effectiveness of cooled radiofrequency ablation to corticosteroid injection in the management of the knee pain from osteoarthritis. Reg Ane Pain Med., 43: 84-91.
13. Fernandes, L., K.B. Hagen, J.W.J. Bijlsma, O. Andreassen and P. Christensen et al., 2013. Eular recommendations for the non-pharmacological core management of hip and knee osteoarthritis. Ann. Rhe Dis., 72: 1125-1135.
14. McAlindon, T.E., R.R. Bannuru, M.C. Sullivan, N.K. Arden and F. Berenbaum et al., 2014. Oarsi guidelines for the non-surgical management of knee osteoarthritis. Oste Cart., 22: 363-388.
15. Hochberg, M.C., R.D. Altman, K.T. April, M. Benkhalti and G. Guyatt et al., 2012. American college of rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. Arthritis. Care. Res., 64: 465-474.
16. Donnerer, J., 2003. Regeneration of primary sensory neurons. Pharmacology, 67: 169-181.
17. Rojhani, S., Z. Qureshi and A. Chhatre, 2017. Water -cooled radiofrequency provides pain relief, decreases disability, and improves quality of life in chronic knee osteoarthritis. Aim J Phys Med Re., 86: 5-8.
18. Choi, W.J., S.J. Hwang, J.G. Song, J.G. Leem, Y.U. Kang, P.H. Park and J.W. Shin, 2011. Radiofrequency treatment relieves chronic knee osteoarthritis pain: A double-blind randomized controlled trial. Pain, 152: 481-487.
19. Bellini, M. and M. Barbieri, 2015. Cooled radiofrequency system relieves chronic knee osteoarthritis pain: the first case -series. Ana Inte Ther., 47: 30-33.