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Clinical outcome of Cooled Radiofrequency ablation in chronic knee pain osteoarthritis: An initial experience from Nepal

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ABSTRACT

Background: Cooled Radiofrequency ablation is a newer technique for management of chronic knee pain in osteoarthritis. The aim of the study is to evaluate the clinical outcomes in patients with chronic osteoarthritis in terms of pain scores for first six months of cooled radiofrequency ablation using ultrasound guidance.

Methods: A cross-sectional study with retrospective review of database was evaluated to analyze the change in the Numerical Rating Scale from baseline scores at 1 day, 1 month and 6 months after the Cooled Radiofrequency ablation of genicular nerves around knee in patients with chronic knee osteoarthritis.

Results: Median age was 71 years [61-73 years (IQR: 25-75)] with more female preponderance. Numerical Rating Scale (Mean ± S.D.) was significantly less at 1 day (1.87 ± 1.22), 1 month (3.03 ± 0.99) and 6 months (3.37 ± 1.098) from baseline values (6.77 ± 1.00). No soreness and numbness were noted.

Conclusions: Cooled Radiofrequency using Ultrasound guidance for management of knee pain in chronic osteoarthritis is promising and reduces Numerical Rating Score significantly from baseline at 1 month and 6 months respectively.

Keywords: Cooled radiofrequency ablation; genicular nerve; numeric rating scale

INTRODUCTION

Radiofrequency ablation (RF) pulsed or cooled is a proven technique for patient with severe chronic knee pain with least complication both in terms of substantial reduction in pain scores as well as benefits in functional abilities.[1] Compared to conventional RF, Cooled Radiofrequency (CRF) have more advantage of avoiding charring effect and subsequent insulation due to better size and shape limitation. It delivers more energy to surrounding tissues, creating larger mean lesion volume with subsequent larger spherical lesion compared to conventional RF which can provide extensive denervation and reduce chances of missing the target nerve. This will eventually correlate with degree and duration of pain relief and improved functional outcomes even beyond 12 months period with negligible safety concerns[2] making it modality for long-term management of chronic knee pain.[3] Moreover, repeat CRF has also demonstrated similar results compared to first CRF.[4] The experiences we generate is new and may pave the pathway for development of management of chronic knee pain in low middle-income country like Nepal. The aim of the study was to evaluate the clinical outcomes in patients with chronic osteoarthritis in terms of pain scores for first six months of cooled radiofrequency ablation using ultrasound.

METHODS

This was a cross-sectional study where retrospective chart review was done in patients who has undergone Cooled Radiofrequency ablation from June 2019 to June 2020 in Civil Service Hospital, Nepal. Ethical approval for this study was taken from the institutional review board. Patients were also taken written informed consent at the time of procedure regarding the details of the procedure and risk associated. All patient whose were on complete follow up were included in the study. Patient who abandoned procedures in between due to difficulty, had repeat procedures, lost to follow up were excluded from the study. Total 30 patients were evaluated who had fit the inclusion criteria.

Procedure was performed in minor operating room,

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under all aseptic precaution. Asepsis of Probe and connecting cable was maintained with 5% betadine and 90% alcohol. For diagnostic block, 1ml of 0.5% lidocaine was injected in all genicular nerves. Ablation were carried out if there was pain relief of 50% or more after half an hour following diagnostic block was noted. Before the cooled RF, patient was sedated with Intravenous Midazolam 0.03 mg/kg and Fentanyl 0.5 mcg/kg. Patient requiring Intravenous Propofol for sedation were topped with aliquots of 2 ml (20mg) till the patient achieved moderate level of sedation. Post procedure, patients were advised for oral acetaminophen 1 gram twice daily for first days. Patients were followed up for first day, 1 months and 6 months post procedures for reduction in NRS score from baseline. Patients were also asked for soreness and numbness at the site of cooled RF during the time period. Some patients who didn't visit in 6 months period were called from the phone interview and asked regarding NRS reduction and complications and noted in the chart.

Ultrasound Linear probe 5-11 Hz (MINDRAY M7) was used to identify genicular artery. Probe was initially placed at lower end of femur in short axis to artery aiming to visualize metaphysis and diaphysis junction. For Superior medial genicular nerve (SMGN) probe was placed in medial side with knee externally rotated, flexed and abducted to achieve optimal scan. Genicular artery was visualized which lies near adductor tubercle. Genicular artery was identified as pulsating structure at junction of metaphysic and diaphysis of femur. Probe initially was placed longitudinally to obtain short axis view of artery then rotated to obtain long axis view of artery which help find proximity to nerve (Figure 1). Once confirmed probe was placed in short or long axis whichever is appropriate for better visualization of artery and the hence the nerve in close proximity. Similarly, in same position scanning was done in medial aspect of junction between metaphysis and diaphysis of tibia to identify inferior medial Genicular artery (IMGN) and hence nerve. SMGN & IMGN were ablated in same setting. For Superior lateral Genicular Nerve (SLGN) knee was internally rotated, abducted to achieve optimal position to scan. Scanning was done on lateral side to visualize Superior Lateral Genicular around metaphysis and diaphysis of femur below biceps femurs muscle in short axis. Metaphysis and Diaphysis junction with more than 50 % depth of femur is used for ablation in case artery or nerve were difficult to visualize. Skin was infiltrated with 0.5% Local Anesthesia before cannulation (17 G, 100 mm length with 4 mm active tip)

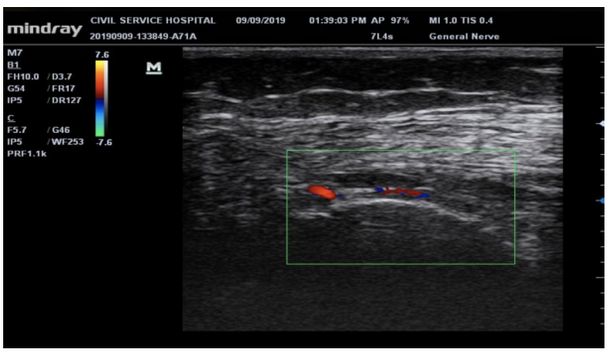

Figure 1. Genicular artery in long axis view in metaphysis and diaphysis junction for genicular nerve close proximity.

Paresthesia in distribution of nerve was obtained with sensory stimulation at 50 Hz (HALYARD, cooled RF) with pulse duration of 1 millisecond and for motor 2 HZ frequency at 1-2 V. Cooled RF Auto Temperature mode was used and time set was 90 seconds for genicular nerves.

Data was entered in Microsoft Excel 2016 and analyzed using SPSS version 24. Age, Numerical rating score (NRS), was identified as continuous variable. Paired T-test was used to see the change in NRS from the baseline score at 1 day, 1 month and 6 months after the procedure was done.

RESULTS

Total 35 patients were retrospectively reviewed in the chart and only 30 fit the inclusion criteria. Remaining 5 patients were lost to follow up and two didn't have satisfactory improvements after 30 minutes of diagnostic injections.

Table 1. Baseline Characteristics (N=30)

Baseline Characteristics	Values
Age [Mean (S.D.)]	68.10 (11.17), 71.00 (Median) [61-73 (IQ 25- IQ 75)]
Gender (M/F)	11/19

Most of the cases were with mean age of 68 years with median value of 71 years. There was more preponderance of female in the cases (Table 1).

Table 2. Comparison of NRS Score at different time intervals

	Mean (Standard Deviation)	95% Confidence Interval of the Difference (Upper - Lower)	P- value (student t- test)
Baseline NRS Vs NRS 1 day	6.77 (1.006)	5.499 - 4.301	0.000
	1.87 (1.224)		
Baseline NRS Vs NRS 1month	6.77 (1.006)	4.296 - 3.171	0.000
	3.03 (0.999)		
Baseline NRS Vs NRS 6 month	6.77 (1.006)	4.040 - 2.760	0.000
	3.37 (1.098)		

As illustrated in Table 2, NRS has reduced by approximately 55% in one month of CRF and 50% in 6 months. (Figure 1).

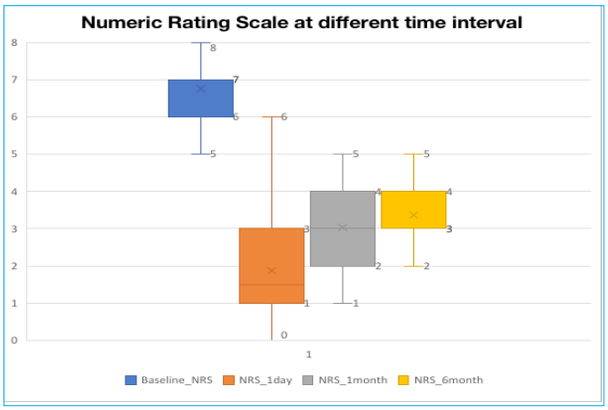

Figure 2. Numeric Rating Score (NRS) Score at baseline, 1 day, 1 month and 6 months interval.

DISCUSSIONS

Ultrasound guided technique has advantage over fluoroscopic guided technique as it has no radiation exposure. The soft tissue around the nerve are well visualized, along with vascular structure near the nerve providing opportunity for accurate needle placements with dynamic images. Fluoroscope may not be available at all places compared to ultrasound access which can be a useful alternative particularly in low- and middle-income countries. Dustin has well demonstrated in his studies that ultrasound can be useful and equally efficacious for nerve identification and correct probe placement.[5] In contrast to fluoroscopy, ultrasound allowed the visualization of neuro- vascular bundles, soft tissue structures and, presumably, more accurate nerve identification.[6] In cadaveric studies using indocyanine dye where ultrasound was used to find the difference in distance of nerve from the RF probe, no significant differences was found in SLGN, SMGN and IMGN.[7] Metanalysis of 8 published data with 256 patients showed that Ultrasonography is an effective, safe, nonradiative, and easily applicable guidance method for RF in pain relief and functional improvement in knee osteoarthritis patients, however most studies did short term follow up and lacked data for long term efficacy.[8]

As illustrated in Table 2, NRS reduced by approximately 55% in one month of CRF and 50% in 6 months. NRS score plateaued for duration of 1 to 6 months in patients with chronic knee pain. Randomized controlled trial (RCT) with cooled RF had shown almost 58-64% reduction in pain scores at 6 months.[9] Similar findings are shown by other another trial where there was significant reduction pain score ($p < 0.007$) by almost 71% from the baseline in first 6 months.[10] Interestingly, Kapural in his retrospective analysis with 183 patients even demonstrated reduction in pain NRS by more than 50% in 65% of the subjects at 12.5 months with 26 % having no pain at all after cooled RF.[4] Another studies, showed the similar finding with NRS scale in cohort of patients who were unresponsive to steroid for chronic osteoarthritis for more than 6 months. Fall in pain scores when compared with these studies are slightly less in our studies which may be attributed to using Ultrasound for finding the nerve as an initial experience. All studies were in contrast were performed under fluoroscopic guidance. However, study by Dustin with 22 patients also showed reduction in pain scores by 50-100 % in almost 82 % of the participant with osteoarthritis in his retrospective review with no adverse sequelae related to the procedures. Case series done using ultrasound in a similar setup with eight patients have shown significant reduction in NRS score ($p < 0.05$) at rest, movement and while weight bearing at 1 month, 6 months from baseline in patient with osteoarthritis grade 3 and 4.[11]

Pain scores at 1-day reduction may be overestimated as we have used fentanyl and Propofol along with local anesthetics during the procedure and oral acetaminophen was given on discharge for first two days. Most of the NRS records for 6 months was recorded as phone interview and there is tendency that elderly may not be able to comprehend clearly. Most of genicular nerve targets were taken in close proximity to artery and the bone landmark. Our studies only gives the glimpse of initial experience of use of ultrasound which can be readily available tool for cooled Radiofrequency ablation in low- and middle-income country.

CONCLUSIONS

Cooled Radiofrequency using Ultrasound guidance for management of knee pain in chronic osteoarthritis is promising and reduces NRS score significantly from baseline at 1 month and 6 months respectively. Use of ultrasound for identified genicular nerve at different location of knee can be useful along with cooled RF and is recommended in low resource setting where fluoroscopic is difficult to find.

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