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Original Research Article

Comparative Assessment of the Outcome in Patients with Knee Osteoarthritis Treated Using of TENS Therapy and Ultrasound-Guided Genicular Nerve Block

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Abstract

Aim: Comparison of the Therapeutic Efficacy of TENS vs Ultrasound-guided Genicular Nerve Block in Patients with Knee Osteoarthritis.

Methods: Total 50 patients were included in this study, 25 each in the TENS group and GNB group, respectively. Primary OA knee, Radiologic K/L (Kellgren-Lawrence Grading Scale) score: 3 and 4, Age: 40–80 years, poorly responding to initial treatments, Patients unwilling or contraindicated for surgical management and Visual acuity scale (VAS) >5 were included in this study. All the subjects recruited in our study underwent some baseline routine blood investigation. The total study population (n = 50) was divided into two groups (25 in each group) randomly. Before starting treatment, basic information like age, sex, and duration of disease were noted and baseline VAS and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) were calculated. A short course of acetaminophen tablet, lifestyle modification, and therapeutic exercise regimen was prescribed and followed.

Results: All numerical variables were found to be normally distributed by Kolmogorov–Smirnoff goodness-of-fit. The mean age of patients in TENS group (n = 25) was around 54.26 (±7.68) years and in GNB group (n = 25) was 55.63 (±6.97) years. a comparison of the numerical variable VAS for pain between both the groups by Student's unpaired "t" test shows, after continuous 3 weeks of daily TENS therapy, knee pain improved from a mean VAS of 7.35 (±0.81) at baseline to 3.66 (±1.14) at the end of 1 month. Whereas, with a single sitting of GNB, the mean VAS improved from a baseline value of 7.41 (±0.86) to 2.87 (±0.92) at the end of 1 month. Thus, GNB shows a significantly better result ($p < 0.05$) in improving knee pain than TENS therapy at 1 month. Although at the end of 3 months, the VAS in both the groups again becomes comparable ($p = 0.21$). In the TENS group, WOMAC improved from a mean of 47.23 (±6.10) at baseline to 27.44 (±5.87) at the end of 1 month. In the GNB group (group II), the mean WOMAC improved from a baseline value of 46.69 (±5.85) to 24.44 (±4.81) at the end of 1 month. Thus, similar to pain, GNB shows significant better result ($p < 0.05$) in improving knee stiffness and function than TENS therapy at 1 month. At the end of 3 months, the WOMAC in both the groups again becomes comparable ($p = 0.82$.)

Conclusion: We concluded that GNB is a better choice than TENS in the short-term and comparable in the long term and both add to the OA knee rehabilitation program significantly.

Keywords: GNB, TENS, OA knee.

Introduction

Osteoarthritis (OA) is one of the most common degenerative joint diseases among elderly individuals, and knee joints are the most affected joints [1,2]. Pain, joint stiffness, and decreased muscle strength can be seen, and cause poor quality of life and poor functional capacity [3]. Conservative pharmacological treatments such as oral analgesics, viscosupplementation, intraarticular corticosteroid injections, acupuncture, and prolotherapy, as well as non-pharmacological treatments, may be inadequate [4]. When conservative treatment fails, total knee joint arthroplasty may be an option; however, total knee arthroplasty can't be performed on all patients because some patients have comorbidities and the risk of surgery complications [5]. Genicular nerve block (GNB) is demonstrated from several reports to alleviate pain and improve knee functionality in patients with chronic knee OA [6,8]. Ultrasound (US) has been the most used imaging to aid in landmark targeting and procedural accuracy in recent studies. The genicular nerves are the main innervating articular branches for the knee joint, and as they are adjacent to the periosteum, connecting the bone, they can be located using bony landmarks. Superomedial, inferomedial, and super lateral genicular nerve (SMGN, IMGN, and SLGN) branches have been targeted for these treatment options in previous studies [7,9]. The location of these nerves, their anatomical relationship with surrounding tissues, and their origin and termination become better understood through cadaveric studies; therefore, it is possible to per- form GNB without imaging [10,11].

Material and methods

This prospective randomized control study conducted in the Department of Physical Medicine and Rehabilitation, Patna Medical College, Patna, Bihar, India, for 3 months

Methodology

Total 50 patients were included in this study, 25 each in the TENS group and GNB group, respectively. Primary OA knee, Radiologic K/L (Kellgren-Lawrence Grading Scale) score: 3 and 4, Age: 40–80 years, poorly responding to initial treatments, Patients unwilling or contraindicated for surgical management and Visual acuity scale (VAS) >5 were included in this study. patients with Prior knee surgery, Secondary OA, Associated sciatic or other neuropathic pain, Intra-articular corticosteroid or visco-supplementation injection within the last 3 months, The presence of an unstable medical condition or a known uncontrolled systemic disease, including cancer, diabetes, coagulopathy, major depression, and schizophrenia and Patients with contraindications of steroid injections, i.e., overlying soft tissue sepsis, bacteremia, anatomic inaccessibility, and uncooperative patient were excluded in this study.

All the subjects recruited in our study underwent some baseline routine blood investigation. The total study population (*n* = 50) was divided into two groups (25 in each group) randomly. Before starting treatment, basic information like age, sex, and duration of disease were noted and baseline VAS and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) were calculated. A short course of acetaminophen tablet, lifestyle modification, and therapeutic exercise regimen was prescribed and followed.

The first group of patients received TENS around the knee with 100 Hz frequency and 200-ms pulse. Two pairs of rubber electrodes were placed over the acupuncture points of the knee. The duration was set to 40 minutes. This was procedure was repeated daily for 3 weeks.

In the second group, the GNB was performed in the operation theater with appropriate monitoring and aseptic precautions. Samsung Medison PT60A Diagnostic Ultrasound system and Medison

LN5-12 transducer were used for identification of the sonoanatomic landmarks. Superolateral, SM, and IM genicular nerves were located. The SL genicular nerve was located at the junction of the lateral femoral shaft and the lateral femoral condyle. The SM was identified about 1 cm anterior to the adductor

tubercle, accompanied by the SM genicular vessels after keeping the transducer in a sagittal plane over medial femoral condyle and gradually translating it proximally. Inferomedial genicular nerve is identified keeping the transducer horizontally near the medial tibial epicondyle at the midpoint between the medial epicondyle and the tibial insertion of the medial collateral ligament. A 22-gauge spinocaine needle was introduced in parallel to the long axis of the transducer. Each block was done with 2 mL solution from a standard mixture of Inj. lignocaine 2% 3 mL + Inj. 0.25% bupivacaine 2 mL + depot methylprednisolone 40 mg/mL 1 mL.

Assessment of VAS and WOMAC was done at baseline and 1 month and 3 months after GNB and completion of TENS therapy. At the end of the study, all the demographic and other numerical data were collected and tabulated. The data were analyzed by standard statistical tools.

Data were compared between baseline and follow-up assessments and in-between the two groups by repeated measures analysis of variants (ANOVA) and Student's unpaired *t*-test. respectively, for numerical variables and by Fisher's exact test for categorical variables. The analysis was two-tailed and $p < 0.05$ was considered statistically significant.

All numerical variables were found to be normally distributed by Kolmogorov–Smirnoff goodness-of-fit.

Results

The mean age of patients in TENS group ($n = 25$) was around 54.26 (±7.68) years and in GNB group ($n = 25$) was 55.63 (±6.97) years. In both groups, female preponderance was found (60%). Fisher's exact test showed no statistically significant difference (p value 1.000) in the proportion of males and females between the two groups.

Comparison of changes over time within respective groups was done by repeated measures ANOVA. It shows progressive improvement in both the parameters (VAS for pain and WOMAC) in both the treatment groups. Tukey's multiple comparison test also shows significant improvement in every follow-up.

As shown in Table 1, a comparison of the numerical variable VAS for pain between both the groups by Student's unpaired "*t*" test shows, after continuous 3 weeks of daily TENS therapy, knee pain improved from a mean VAS of 7.35 (±0.81) at baseline to 3.66 (±1.14) at the end of 1 month. Whereas, with a single sitting of GNB, the mean VAS improved from a baseline value of 7.41 (±0.86) to 2.87 (±0.92) at the end of 1 month. Thus, GNB shows a significantly better result ($p < 0.05$) in improving knee pain than TENS therapy at 1 month. Although at the end of 3 months, the VAS in both the groups again becomes comparable ($p = 0.21$).

Knee stiffness and function were measured through Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). According to Table 2, a comparison of the numerical variable WOMAC between both the groups by Student's unpaired "*t*" test shows, in the TENS group, WOMAC improved from a mean of 47.23 (±6.10) at baseline to 27.44 (±5.87) at the end of 1 month. In the GNB group (group II), the mean WOMAC improved from a baseline value of 46.69 (±5.85) to 24.44 (±4.81) at the end of 1 month. Thus, similar to pain, GNB shows significant better result ($p < 0.05$) in improving knee stiffness and function than TENS therapy at 1 month. At the end of 3 months, the WOMAC in both the groups again becomes comparable ($p = 0.82$.

Table 1: Comparison of VAS for pain between TENS and GNB

VAS	Group I TENS		Group II GNB		p-value
	Mean	SD	GNB	SD	
Baseline	7.35	0.81	7.41	0.86	0.89
1 month	3.66	1.14	2.87	0.92	0.02
3 month	2.61	0.93	1.99	0.83	0.21

Table 2: Comparison of WOMAC between TENS and GNB

WOMAC	Group I TENS		Group II GNB		p-value
	Mean	SD	Mean	SD	
Baseline	47.23	6.10	46.69	5.85	0.81
1 month	27.44	5.87	24.44	4.81	0.12
3 month	16.35	2.95	14.35	2.97	0.82

Discussion

The patients in both groups had significant pain relief and improvement in knee functions throughout a follow-up period of 3 months. As we found in the TENS group, Paker et al. also found in their study with daily therapy of high-frequency TENS, there was significant ($p < 0.001$) improvement of both VAS and WOMAC over time [12].

As in the study by Kesikburun et al., we also found that there is a significant improvement of VAS and WOMAC after GNB under USG guidance over 1 and 3 months, although they used radiofrequency ablative block [13].

In this study, there is a statistically significant improvement difference at 1 month in knee pain, stiffness, and function with the GNB group being superior to the TENS group.

However, like other studies, our study has some limitations. Both the study parameters were subjective. Knee joint range of motion was not taken into account. Long-term follow-up could not be done.

Conclusion

We concluded that GNB is a better choice than TENS in the short-term and comparable in the long term and both add to the OA knee rehabilitation program significantly.

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