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EVALUATE THE EFFICACY OF GENICULAR NERVE BLOCK (GNB) AND INTRAARTICULAR CORTICOSTEROID INJECTION (IACSI) IN PATIENTS WITH KNEE OSTEOARTHRITIS (OA).

Anaesthesiology

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ABSTRACT

Background: Knee osteoarthritis (OA) is a leading cause of chronic pain and disability in the elderly, often managed with intra-articular corticosteroid injections (IACSI). However, their analgesic effect is short-lived. Genicular nerve block (GNB) has emerged as a promising technique for longer-lasting pain relief. This study aimed to evaluate and compare the efficacy of IACSI alone and in combination with GNB in patients with knee OA. **Methods:** A prospective, randomized study was conducted at tertiary care center in North India involving 60 patients diagnosed with moderate (Kellgren–Lawrence grade II–III) knee OA. Participants were randomly allocated into two groups of 30 each: Group A received IACSI alone, and Group B received IACSI combined with GNB under ultrasound guidance. Pain and functional outcomes were assessed using the Visual Analog Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Patient Global Impression of Change (PGIC) at baseline, 1 week, 1 month, 3 months, and 6 months. Duration of analgesia and paracetamol consumption were also recorded. **Results:** Both groups showed significant improvement in VAS and WOMAC scores post-intervention; however, Group B demonstrated greater and longer-lasting improvement at all follow-ups ($p < 0.001$). The mean duration of analgesia was significantly higher in Group B (4.7 ± 1.0 months) compared to Group A (2.9 ± 0.9 months). Paracetamol consumption was also lower in Group B ($p < 0.001$). **Conclusion:** Combining genicular nerve block with intra-articular corticosteroid injection provides superior, prolonged pain relief and functional improvement compared to corticosteroid injection alone, offering an effective, minimally invasive treatment option for knee osteoarthritis.

KEYWORDS

Knee osteoarthritis, genicular nerve block, intra-articular corticosteroid, pain management, ultrasound-guided injection.

INTRODUCTION

Osteoarthritis (OA) of the knee is the most common degenerative joint disorder and a major cause of chronic pain, disability, and poor quality of life in older adults worldwide.[1,2] The disease is characterized by progressive loss of articular cartilage, subchondral bone remodeling, and synovial inflammation, leading to pain, stiffness, and reduced joint mobility.[3] The global prevalence of knee OA has been steadily rising with increasing age, obesity, and sedentary lifestyles, posing a significant public health burden.[4,5]

Conservative management remains the mainstay of early disease treatment and includes pharmacological therapy, lifestyle modification, and intra-articular injections.[6,7] Among these, intra-articular corticosteroid injections (IACSI) are commonly used for short-term pain relief owing to their potent anti-inflammatory properties.[8] However, the effects are often transient, lasting from a few weeks to a few months, and repeated injections may accelerate cartilage degeneration or induce systemic side effects.[9,10]

In recent years, genicular nerve block (GNB) has emerged as a promising minimally invasive technique for managing chronic knee pain. It involves the selective blockade of articular sensory branches that innervate the knee joint—specifically, the superomedial, superolateral, and inferomedial genicular nerves.[11] When performed under ultrasound or fluoroscopic guidance, GNB provides targeted analgesia by interrupting nociceptive transmission without affecting motor function.[12] Previous studies have demonstrated that GNB can significantly reduce pain in patients with knee OA, either as a standalone intervention or in conjunction with intra-articular therapy.[11,13]

Combining IACSI with GNB may have a synergistic effect-corticosteroids reduce intra-articular inflammation, while GNB alleviates peripheral nociceptive input, potentially prolonging pain relief. Yilmaz et al. reported that patients receiving both IACSI and GNB experienced greater improvements in pain and function than those receiving IACSI alone.[14] Nevertheless, evidence remains limited, and data from Indian populations are scarce.

Hence, this study aimed to evaluate and compare the efficacy of intra-articular corticosteroid injection alone versus combined with genicular nerve block in patients with knee osteoarthritis, in terms of pain reduction and functional improvement.

Methods

This prospective, randomized, comparative study was conducted in the Department of Anaesthesiology and Pain Medicine at a tertiary care center in North India, after obtaining approval from the Institutional Ethics Committee and written informed consent from all participants. A total of sixty patients with primary knee osteoarthritis (OA), diagnosed according to the American College of Rheumatology criteria and confirmed radiographically as Kellgren–Lawrence (KL) grade II or III, were enrolled. Patients were randomly allocated into two equal groups of thirty each using a computer-generated randomization sequence. Group A received intra-articular corticosteroid injection (IACSI) alone, whereas Group B received a combination of intra-articular corticosteroid injection and genicular nerve block (GNB). Allocation concealment was ensured using sealed opaque envelopes, and the outcome assessor remained blinded to group assignments to minimize bias.

Patients aged between 40 and 75 years, presenting with chronic knee pain of at least three months' duration and a baseline visual analogue scale (VAS) score of ≥40 mm, were included in the study. Patients with inflammatory or septic arthritis, previous intra-articular injection within the last three months, local infection at the injection site, uncontrolled diabetes mellitus or hypertension, coagulopathy, prior genicular radiofrequency ablation, or history of major knee surgery were excluded from participation.

All procedures were performed under strict aseptic precautions in the operation theatre under ultrasound guidance by an experienced anesthesiologist. Patients were placed supine with the knee slightly flexed and a pillow under the popliteal fossa. The skin over the knee was prepared with povidone-iodine and draped in a sterile manner. In both groups, an intra-articular injection was administered into the suprapatellar pouch using a 22-gauge needle under ultrasound guidance. A mixture of 40 mg methylprednisolone acetate with 4 mL of 0.25% bupivacaine was injected slowly after negative aspiration for blood. In Group B, following intra-articular injection, ultrasound-guided genicular nerve block was performed using a high-frequency (6–13 MHz) linear transducer. The superomedial, superolateral, and inferomedial genicular nerves were identified adjacent to their respective genicular arteries at the junction of the shaft and condyle of the femur or tibia. After identifying the target sites, 1.5 mL of 0.5% bupivacaine combined with 20 mg triamcinolone was injected around each of the three nerves under real-time ultrasound visualization. The needle tip was positioned just superficial to the periosteum to avoid vascular puncture. All patients were observed for 30 minutes post-procedure for any immediate adverse effects.

Baseline demographic data, disease duration, and pain scores were recorded before the procedure. Pain intensity was assessed using the Visual Analogue Scale (VAS, 0–100 mm), and functional status was evaluated using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) at baseline, 1 week, 1 month, 3 months, and 6 months after the intervention. The Patient Global Impression of Change (PGIC) was also documented at each follow-up

visit. Patients were advised to continue previously prescribed physiotherapy and were permitted to use paracetamol (up to 3 g/day) as rescue analgesia, the consumption of which was recorded.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Intergroup comparisons were made using the unpaired Student's T-test for continuous variables and the chi-square test for categorical variables. Changes in pain and functional scores over time were analyzed using repeated measures analysis of variance (ANOVA). A p-value < 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

In our study, both study groups were comparable at baseline in terms of demographic and clinical characteristics. The mean age of patients in Group A (IACSI) was 61.4 ± 7.8 years, while that in Group B (IACSI + GNB) was 60.6 ± 8.1 years. The gender distribution was similar, with 12 males and 18 females in Group A and 10 males and 20 females in Group B. The mean body mass index (BMI) was 27.3 ± 3.4 kg/m² in Group A and 26.8 ± 3.6 kg/m² in Group B, showing no significant difference between groups. The average duration of symptoms was 4.8 ± 2.1 years in Group A and 5.0 ± 1.9 years in Group B, indicating comparable disease chronicity. Radiological grading according to the Kellgren–Lawrence classification showed similar distribution, with 14 patients having grade II and 16 patients having grade III osteoarthritis in Group A, and 15 patients each with grade II and grade III disease in Group B. Baseline pain and functional scores were also comparable between groups; the mean Visual Analogue Scale (VAS) score was 7.9 ± 0.8 in Group A and 8.1 ± 0.7 in Group B, while the mean Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score was 68.5 ± 6.3 and 69.4 ± 6.8, respectively. All baseline parameters demonstrated no statistically significant difference ($p > 0.05$), confirming effective randomization and homogeneity of the two groups before the intervention.

VAS Scores Over Time

In this study, pain assessment using the Visual Analogue Scale (VAS) demonstrated a significant reduction in pain scores in both groups following the interventions. In Group A (IACSI), the mean baseline VAS score of 7.9 ± 0.8 decreased to 4.5 ± 0.9 at 1 week, 4.9 ± 1.0 at 1 month, 5.7 ± 1.2 at 3 months, and 6.6 ± 1.1 at 6 months, indicating progressive pain relief that gradually diminished over time. In contrast, Group B (IACSI + GNB) showed a more pronounced and sustained improvement, with mean VAS scores reducing from 8.1 ± 0.7 at baseline to 3.9 ± 1.0 at 1 week, 3.5 ± 0.9 at 1 month, 3.7 ± 1.0 at 3 months, and 4.2 ± 1.0 at 6 months. The intergroup comparison revealed that pain relief was significantly greater in Group B at all follow-up intervals beyond the first week, with p-values of 0.001 at 1 month, <0.001 at 3 months, and <0.001 at 6 months. This demonstrates that although both intra-articular corticosteroid injection alone and the combination with genicular nerve block were effective in reducing pain, the addition of GNB provided superior and longer-lasting analgesia over the six-month follow-up period.

WOMAC Scores Over Time

The comparison of WOMAC scores over time revealed a significant improvement in both groups following treatment. In Group A (IACSI), the mean WOMAC score decreased from 68.5 ± 6.3 at baseline to 45.2 ± 6.9 at 1 week, indicating early improvement in pain, stiffness, and joint function. However, the scores gradually increased over time to 47.8 ± 7.2 at 1 month, 51.6 ± 7.5 at 3 months, and 58.3 ± 6.9 at 6 months, suggesting a gradual decline in therapeutic benefit. In Group B (IACSI + GNB), the WOMAC scores showed a more pronounced and sustained improvement, reducing from 69.4 ± 6.8 at baseline to 40.6 ± 7.1 at 1 week, 38.9 ± 6.5 at 1 month, 39.8 ± 6.1 at 3 months, and 43.2 ± 6.3 at 6 months.

The intergroup comparison demonstrated statistically significant differences between the two groups at all follow-up points beyond baseline, with p-values of 0.02 at 1 week, 0.001 at 1 month, and <0.001 at both 3 and 6 months. These results indicate that while both interventions improved functional outcomes, the combination of intra-articular corticosteroid injection and genicular nerve block provided superior and longer-lasting functional improvement compared to intra-articular corticosteroid injection alone.

Patient Global Impression of Change (PGIC) at 6 Months

At the six-month follow-up, patient satisfaction and perceived improvement were evaluated using the Patient Global Impression of Change (PGIC) scale. The results demonstrated a higher proportion of favorable responses in the group receiving combined intra-articular corticosteroid injection with genicular nerve block (IACSI + GNB) compared to the group receiving intra-articular corticosteroid injection (IACSI) alone. In Group A, 5 patients (16.7%) reported being "very much improved" and 7 patients (23.3%) reported being "much improved." In contrast, in Group B, 11 patients (36.7%) each reported "very much improved" and "much improved" outcomes. A larger proportion of patients in Group A showed only minimal improvement (33.3%) or no change (20.0%) compared to Group B, where 6 patients (20.0%) reported minimal improvement and 2 patients (6.6%) reported no change. Additionally, worsening of symptoms was reported by 2 patients (6.7%) in Group A, whereas none were observed in Group B. The overall difference in patient-reported outcomes between the two groups was statistically significant ($p = 0.03$).

Duration Of Analgesia And Rescue Analgesic Requirement

The comparison of analgesic efficacy parameters between the two groups showed that patients receiving combined intra-articular corticosteroid injections with genicular nerve block (Group B) experienced significantly longer pain relief and required less rescue medication compared to those receiving intra-articular corticosteroid injection alone (Group A). The mean duration of analgesia in Group A was 2.9 ± 0.9 months, whereas in Group B it was markedly prolonged to 4.7 ± 1.0 months ($p < 0.001$), indicating sustained pain relief with the addition of GNB. Furthermore, monthly paracetamol consumption was significantly lower in Group B (2.3 ± 1.0 g/month) compared to Group A (4.1 ± 1.3 g/month) ($p < 0.001$), reflecting reduced dependence on analgesics. These findings suggest that the combination of IACSI and GNB provides superior and longer-lasting analgesic efficacy compared to IACSI alone in patients with knee osteoarthritis.

DISCUSSION

The present study was conducted to evaluate and compare the efficacy of intra-articular corticosteroid injection (IACSI) alone and in combination with genicular nerve block (GNB) in patients with knee osteoarthritis (OA). The results demonstrated that both treatment modalities significantly improved pain and functional outcomes, but the combination therapy (IACSI + GNB) provided superior and longer-lasting analgesia, greater functional improvement, and reduced analgesic consumption over a six-month follow-up period.

Knee OA is a chronic degenerative joint disorder characterized by progressive articular cartilage loss, osteophyte formation, and synovial inflammation, leading to pain, stiffness, and functional disability.[15,16] Although pharmacologic agents such as NSAIDs and corticosteroids remain the cornerstone of symptomatic management, their efficacy is often limited and short-lived, particularly in moderate to advanced disease.[17] Intra-articular corticosteroid injection is commonly used to provide temporary relief by reducing synovial inflammation and joint effusion.[8,9] However, several studies have reported that its analgesic effect typically lasts for only 4 to 12 weeks,[18,19] consistent with the mean analgesic duration of 2.9 months observed in our IACSI group.

In contrast, genicular nerve block targets the articular branches of sensory nerves innervating the knee joint, providing pain relief by interrupting nociceptive transmission without affecting motor function.[20] The combination of GNB with IACSI potentially enhances the overall therapeutic benefit by addressing both inflammatory and neuropathic components of OA pain.[21] In our study, patients receiving combined GNB and IACSI reported significantly greater improvement in both VAS and WOMAC scores across all follow-up intervals, with the most pronounced differences observed at 3 and 6 months ($p < 0.001$). This finding aligns with previous reports by Choi et al.[12] and Santana Pineda et al,[22] who demonstrated that GNB, particularly when guided by ultrasound or fluoroscopy, yields substantial and sustained pain relief in knee OA patients.

The mean duration of analgesia in the IACSI + GNB group was 4.7 months, which was significantly longer than the IACSI group (2.9 months), corroborating the findings of McCormick et al,[23] who noted prolonged analgesia with GNB compared to intra-articular injections alone. Additionally, the reduction in paracetamol consumption

observed in our combination group highlights the opioid-sparing and analgesic-sparing effects of GNB, as similarly reported in other studies.[24]

Improvement in functional outcomes as assessed by WOMAC scores was also greater in the combination group, indicating enhanced joint function and mobility. This can be attributed to improved pain control, allowing for better rehabilitation and daily activity performance.[25] Our findings are supported by Kim et al,[26] who observed that patients undergoing GNB reported improved walking ability and knee function compared to those receiving intra-articular treatments alone.

The mechanism of prolonged benefit may involve modulation of peripheral and central sensitization pathways by blocking nociceptive input from the genicular nerves.[27] Furthermore, combining corticosteroid's anti-inflammatory effect with neural blockade may synergistically reduce both inflammatory and neurogenic pain components, offering comprehensive pain management.[28]

Although our study demonstrated significant clinical benefits, certain limitations must be acknowledged. The sample size was modest, and the follow-up period of six months, though adequate for assessing short- to mid-term outcomes, may not reflect the long-term efficacy of GNB. Additionally, imaging confirmation of genicular nerve anatomy was not uniformly applied in all cases, which might influence precision. Future studies with larger sample sizes, longer follow-ups, and comparative analyses with radiofrequency ablation are warranted to validate these findings.

CONCLUSION

The present study demonstrated that both intra-articular corticosteroid injection (IACSI) alone and in combination with genicular nerve block (GNB) significantly improved pain and functional outcomes in patients with knee osteoarthritis. However, the combination therapy (IACSI + GNB) provided superior and longer-lasting analgesia, greater improvement in WOMAC scores, and a substantial reduction in the need for additional analgesics compared to IACSI alone. These findings suggest that adding GNB to intra-articular corticosteroid injection enhances pain control and functional recovery, offering a more comprehensive and durable treatment option for patients with moderate to severe knee osteoarthritis who are not suitable candidates for surgical intervention. This minimally invasive approach may serve as an effective bridge between conservative management and surgical treatment, improving quality of life and mobility in affected individuals. Further large-scale, long-term studies are warranted to confirm these benefits and optimize treatment protocols.

Table 1: Baseline Characteristics

Parameter	Group A (IACSI) n = 30	Group B (IACSI + GNB) n = 30	*p*-value
Age (years)	61.4±7.8	60.6±8.1	0.71
Sex (Male/Female)	12/18	10/20	0.59
BMI (kg/m²)	27.3 ± 3.4	26.8±3.6	0.62
Duration of symptoms (years)	4.8±2.1	5.0±1.9	0.74
KL grade (II/III)	14/16	15/15	0.79
Baseline VAS score	7.9±0.8	8.1±0.7	0.33
Baseline WOMAC score	68.5±6.3	69.4±6.8	0.58

Table 2: Comparison Of Mean VAS Scores Over Time

VAS Score	Group A (IACSI)	Group B (IACSI + GNB)	*p*-value
Baseline	7.9 ± 0.8	8.1 ± 0.7	0.33
1 Week	4.5 ± 0.9	3.9 ± 1.0	0.04*
1 Month	4.9 ± 1.0	3.5 ± 0.9	0.001*
3 Months	5.7 ± 1.2	3.7 ± 1.0	< 0.001*
6 Months	6.6 ± 1.1	4.2 ± 1.0	< 0.001*

Table 3: Comparison Of WOMAC Scores Over Time

WOMAC Scores	Group A (IACSI)	Group B (IACSI + GNB)	*p*-value
Baseline	68.5 ± 6.3	69.4 ± 6.8	0.58
1 Week	45.2 ± 6.9	40.6 ± 7.1	0.02*
1 Month	47.8 ± 7.2	38.9 ± 6.5	0.001*
3 Months	51.6 ± 7.5	39.8 ± 6.1	< 0.001*
6 Months	58.3 ± 6.9	43.2 ± 6.3	< 0.001*

Table 4: Patient Global Impression of Change (PGIC) At 6 Months

PGIC Category	Group A (IACSI)	Group B (IACSI + GNB)	*p*-value
Very much improved	5 (16.7%)	11 (36.7%)	0.03*
Much improved	7 (23.3%)	11 (36.7%)	
Minimally improved	10 (33.3%)	6 (20.0%)	
No change	6 (20.0%)	2 (6.6%)	
Worse	2 (6.7%)	0 (0%)	

Table 5: Duration Of Analgesia And Rescue Analgesic Requirement

Parameter	Group A (IACSI)	Group B (IACSI + GNB)	*p*-value
Duration of analgesia (months)	2.9 ± 0.9	4.7 ± 1.0	< 0.001*
Paracetamol consumption (g/month)	4.1 ± 1.3	2.3 ± 1.0	< 0.001*

REFERENCES

1. Cross M, Smith E, Hoy D, Nolte S, Ackerman I, Fransen M, et al. The global burden of hip and knee osteoarthritis: estimates from the global burden of disease 2010 study. Ann Rheum Dis. 2014;73:1323–30.
2. Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. Lancet Lond Engl. 2019;393:1745–59.
3. Loeser RF, Goldring SR, Scanzello CR, Goldring MB. Osteoarthritis: a disease of the joint as an organ. Arthritis Rheum. 2012;64:1697–707.
4. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. Indian J Orthop. 2016;50:518–22.
5. Steinmetz JD, Culbreth GT, Haile LM, Rafferty Q, Lo J, Fukutaki KG, et al. Global, regional, and national burden of osteoarthritis, 1990–2020 and projections to 2050: a systematic analysis for the Global Burden of Disease Study 2021. Lancet Rheumatol. 2023;5:e508–22.
6. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019 American College of Rheumatology/Arthritis Foundation Guideline for the Management of Osteoarthritis of the Hand, Hip, and Knee. Arthritis Care Res. 2020;72:149–62.
7. Bannuru RR, Osani MC, Vaysbrot EE, Arden NK, Bennell K, Bierma-Zeinstra SMA, et al. OARSI guidelines for the non-surgical management of knee, hip, and polyarticular osteoarthritis. Osteoarthritis Cartilage. 2019;27:1578–89.
8. Jüni P, Hari R, Rutjes AWS, Fischer R, Silletta MG, Reichenbach S, et al. Intra-articular corticosteroid for knee osteoarthritis. Cochrane Database Syst Rev. 2015;2015:CD005328.
9. Hepper CT, Halvorson JJ, Duncan ST, Gregory AJM, Dunn WR, Spindler KP. The efficacy and duration of intra-articular corticosteroid injection for knee osteoarthritis: a systematic review of level I studies. J Am Acad Orthop Surg. 2009;17:638–46.
10. McAlindon TE, LaValley MP, Harvey WF, Price LL, Driban JB, Zhang M, et al. Effect of Intra-articular Triamcinolone vs Saline on Knee Cartilage Volume and Pain in Patients With Knee Osteoarthritis: A Randomized Clinical Trial. JAMA. 2017;317:1967–75.
11. Hasoon J, Orhurhu VJ, Yazdi C. Genicular Nerve Blocks for the Management of Chronic Knee Pain Related to Osteoarthritis – A Case Series. Orthop Rev. 16:126046.
12. Choi WJ, Hwang SJ, Song JG, Leem JG, Kang YU, Park PH, et al. Radiofrequency treatment relieves chronic knee osteoarthritis pain: a double-blind randomized controlled trial. Pain. 2011;152:481–7.
13. Li Z, Bai Y, Liu C, Gu Y. Efficacy and Temporal Dynamics of Genicular Nerve Block in Primary and Secondary Knee Osteoarthritis for Pain and Function: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. J Pain Res. 2025;18:3037–48.
14. Yilmaz V, Umay E, Gundogdu I, Aras B. The comparison of efficacy of single intraarticular steroid injection versus the combination of genicular nerve block and intraarticular steroid injection in patients with knee osteoarthritis: a randomised study. Musculoskelet Surg. 2021;105:89–96.
15. Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. Lancet Lond Engl. 2019;393:1745–59.
16. Sharma L. Osteoarthritis of the Knee. N Engl J Med. 2021;384:51–9.
17. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019 American College of Rheumatology/Arthritis Foundation Guideline for the Management of Osteoarthritis of the Hand, Hip, and Knee. Arthritis Rheumatol Hoboken NJ. 2020;72:220–33.
18. Bannuru RR, Schmid CH, Kent DM, Vaysbrot EE, Wong JB, McAlindon TE. Comparative effectiveness of pharmacologic interventions for knee osteoarthritis: a systematic review and network meta-analysis. Ann Intern Med. 2015;162:46–54.
19. Raynauld JP, Buckland-Wright C, Ward R, Choquette D, Haraoui B, Martel-Pelletier J, et al. Safety and efficacy of long-term intraarticular steroid injections in osteoarthritis of the knee: a randomized, double-blind, placebo-controlled trial. Arthritis Rheum. 2003;48:370–7.
20. Toubasi AYM, Myles A, Singh P, Sun Z, Dua A. Genicular Nerve Block Versus Genicular Nerve Ablation for Knee Osteoarthritis: A Systematic Review of Randomized Controlled Trials and Retrospective Studies. Cureus. 17:e79106.
21. Ramalho RC, Fernandes TD, Peraro F de F, Pugliese GM, Arliani GG, Ferreira GF. ULTRASOUND-GUIDED GENICULAR NERVE BLOCK FOR KNEE OSTEOARTHRITIS: A CASE SERIES. Acta Ortop Bras. 32:e277781.
22. Ghai B, Kumar M, Makkar JK, Goni V. Comparison of ultrasound guided pulsed radiofrequency of genicular nerve with local anesthetic and steroid block for management of osteoarthritis knee pain. Korean J Pain. 2022;35:183–90.
23. McCormick ZL, Korn M, Reddy R, Marcolina A, Dayanim D, Mattie R, et al. Cooled Radiofrequency Ablation of the Genicular Nerves for Chronic Pain due to Knee Osteoarthritis: Six-Month Outcomes. Pain Med Malden Mass. 2017;18:1631–41.
24. El-Hakeim EH, Elawamy A, Kamel EZ, Goma SH, Gamal RM, Ghandour AM, et al. Fluoroscopic Guided Radiofrequency of Genicular Nerves for Pain Alleviation in Chronic Knee Osteoarthritis: A Single-Blind Randomized Controlled Trial. Pain Physician. 2018;21:169–77.
25. Alshami AM. Knee osteoarthritis related pain: a narrative review of diagnosis and treatment. Int J Health Sci. 2014;8:85–104.
26. Kim DH, Choi SS, Yoon SH, Lee SH, Seo DK, Lee IG, et al. Ultrasound-Guided Genicular Nerve Block for Knee Osteoarthritis: A Double-Blind, Randomized Controlled Trial of Local Anesthetic Alone or in Combination with Corticosteroid. Pain Physician. 2018;21:41–52.
27. Bogduk N. Diagnostic nerve blocks in chronic pain. Best Pract Res Clin Anaesthesiol. 2002;16:565–78.
28. Ragab AR, Hegab S, Elnemr R, Abdel-Kerim A. Intra-articular corticosteroid injection and genicular nerve block under ultrasound guidance in pain control of knee osteoarthritis. Egypt J Radiol Nucl Med. 2021;52:196.