Short Communication

Application of Continuous Proximal Sciatic Nerve Blockade in the Treatment of Flexion Contractures After Primary Total Knee Arthroplasty

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INTRODUCTION

The main objective of total knee arthroplasty (TKA) is to relieve pain and restore normal knee function while providing stability through the gait cycle. However, postoperative flexion contracture can lead to suboptimal overall results.

The purpose of this study was to evaluate the efficacy of employing continuous proximal sciatic nerve blockade (CPSNB) in conjunction with aggressive physical therapy to treat patients with persistent flexion contractures that were recalcitrant to rehabilitation efforts following primary TKA.

METHODS

Patients

Between December 2007 and January 2013, we treated patients with postprimary TKA flexion contractures with CPSNB in conjunction with an aggressive physical therapy regimen. The inclusion criteria consisted of flexion contractures greater than 15° after primary TKA and at least 3 months of conventional physical therapy with no improvement. The exclusion criteria consisted of patients who had clinical or radiographic abnormalities or who refused the treatment. Fifteen patients (15 knees) (12 females and 3 males between 56 and 75 years old with a median age of 67.3 years) enrolled in this study.

The study received full Institutional Review Board approval. All patients gave their written consent for participation before initiation of treatment.

Continuous proximal sciatic nerve block and manipulation

Patients who enrolled in this study were placed in the lateral decubitus position with the surgical side up. The ultrasound-guided infragluteal sciatic nerve block was performed. A catheter was positioned to a depth 4–6 cm beyond the depth of the needle tip. Once the anesthesia was adequate, knee-stretching was gently performed by the orthopedic surgeon. This mobilization was repeated several times and was progressive with the aim of attaining full extension or <5° flexion contracture. After the manipulation, all patients received an infusion of ropivacaine 0.18% through the CPSNB catheter with a baseline rate of 3 mL/h and patient-controlled boluses of 5 mL available every 30 min.

Physical therapy protocol

After patients had returned to the ward, they underwent intensive exercises based on a knee-stretching protocol. An 8-kg sandbag was placed on the anterior surface of the knee to assist in achieving maximum extension [Figure 1]. Each stretching session was performed for 15–20 min 6–8 times/d according to the patients’ tolerance. The sciatic block was stopped on day 5. All patients were discharged on day 7. The passive range of motion (ROM) and visual analog scale (VAS) pain scores during stretching were documented. Following discharge, all patients followed the same knee-stretching regimen at home. Posttreatment follow-up visits were at 1-month, 3 months, 1-year and every year after treatment. At each of these evaluations, the passive ROM, knee flexion contractures, the VAS pain score, Hospital for Special Surgery knee-rating (HSS) score were also documented. The duration between the treatment and the cessation of stretching was also documented.

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Statistical analysis

Repeated measurement ANOVA was used to determine whether there were differences between the pretreatment and posttreatment data of knee flexion contractures, ROM, HSS scores, and VAS scores. The significant level of the repeated measurement was 0.05. Greenhouse–Geisser corrections were used for repeated measures comparisons when the data were found to be nonspherical on Mauchly’s test. All the statistical analysis was conducted with the SPSS version 19.0 software (SPSS Inc., Chicago, USA).

Results

The mean time between the initial surgery and the treatment was 4.6 months (range, 3–12 months). The mean pretreatment passive ROM and knee flexion contractures were 81.1° (range, 60–105°) and 19.9° (range, 15–35°), respectively. The pretreatment VAS scores during stretching, and the HSS scores were 7.3 points (range, 6–10 points), 57.8 points (range, 38–67 points), respectively. Fourteen out of 15 patients completed the treatment and follow-up protocol. The mean treatment time was 2.7 months (range, 2–4 months).

At the time of discharge, the flexion contractures in these patients improved significantly compared with the pretreatment values ($P < 0.001$). Despite having residual contractures, all of the patients tolerated the pain during knee-stretching.

At each of the posttreatment follow-up, compared with pretreatment, the mean flexion contracture, ROM, VAS pain scores and HSS scores gradually improved ($P < 0.001$). At the final follow-up (mean 26.6 months, range, 12–48 months), the amelioration inflexion contracture and HSS scores was maintained compared with the status of 1-year after treatment ($P > 0.05$) [Table 1].

Discussion

The incidence of fixed flexion deformity after TKA ranges from 1.4% to 17%.[1,2] While some studies have shown gradual recovery,[1,3] one study has reported that the condition does not improve postoperatively, especially in cases with more than 15° of flexion contracture.[4]

Until recently, there has been no consensus concerning the preferred treatment algorithm for flexion contractures following TKA. Intensive knee-stretching is of great importance to get the full extension during postoperative physical therapy. However, patients usually complain of severe posterior pain during stretching when the flexion contractures progress beyond a certain angle and last for a long time. More severe the pain, less the patient’s ability to participate in physical therapy. As a result, the patient’s confidence in rehabilitation is diminished, which ultimately leads to more severe flexion contractures.

For flexion contracture, it is important to find a way to continuously reduce the pain and relax the posterior muscles during stretching within a certain time frame in order to solidify the gains of the stretching exercise. This study identified a cohort of patients who continued to show flexion contractures beyond 15° at 3 months after primary TKA and had unsatisfactory clinical outcomes despite rehabilitation efforts. These cases were selected to evaluate the effectiveness of using CPSNB as a combined treatment method in severe cases of flexion contracture.

To the best of our knowledge, this is the first study to evaluate the efficacy of utilizing CPSNB in conjunction with aggressive physical therapy to treat patients with persistent flexion contractures after TKA. Our findings show that, compared with the status before treatment, both the flexion contractures and pain scores had significantly improved at the time of discharge. After discharge, without

| Items | Pretreatment | 1-week | 1-month | 3 months | 1-year | Last follow-up | 1-year vs. last follow-up |
|-------|--------------|--------|---------|----------|--------|----------------|--------------------------|
| FC    | 18.8 ± 4.0   | 3.9 ± 3.2$^*$ | 2.9 ± 2.6$^*$ | 1.4 ± 2.3$^*$ | 1.1 ± 2.1$^*$ | 0.7 ± 1.8$^*$ | 1                       |
| ROM   | 81.6 ± 14.8  | 102.2 ± 9.0$^*$ | 105.0 ± 9.0$^*$ | 108.9 ± 8.8$^*$ | 110.4 ± 9.3$^*$ | 109.6 ± 7.5$^*$ | 1                       |
| VAS   | 7.1 ± 0.7    | 3.6 ± 0.6$^*$ | 1.9 ± 0.8$^*$ | 0.4 ± 0.7$^*$ | 0$^*$ | 0$^*$ | N/A                     |
| HSS   | 59.2 ± 5.5   | N/A    | 82.1 ± 3.1$^*$ | 91.8 ± 2.3$^*$ | 92.5 ± 2.6$^*$ | 92.1 ± 1.7$^*$ | N/A                     |

*Patient who failed the treatment was not included; $^*$ Analyzed by repeated measurement ANOVA; $^*$ Significant difference from the pretreatment value ($P < 0.001$); values are presented as mean ± SD. FC: Flexion contracture; ROM: Range of motion; VAS: Visual analog scale; HSS: Hospital for Special Surgery knee-rating score; N/A: Not applicable; SD: Standard deviation.
anesthesia, all cases had not only locked in the gains from extension but had also made progress. Because the posterior knee pain was gradually relieved, all patients participating in the study were able to withstand the pain during knee-stretching, with simultaneous improvement in both their level of confidence and compliance with the stretching protocol. As a result, they were able to complete the treatment regimen, thereby gradually improving and eventually maintaining the amelioration in flexion contracture and HSS score.

The outcome in this study suggests that patients with severe flexion contracture after TKA for more than 6 months, especially those who develop fixed contractures, may not be appropriate candidates for this treatment protocol, which could lead to a persistent and uncorrectable deformity.

The limitation of this study is the smaller sample size of our patient cohorts. Additional studies with larger patient cohorts are currently underway, and the authors are awaiting the long-term results in order to determine if the promising results obtained in this study are reproducible.

In summary, these findings suggest that CPSNB combined with physical therapy provide improved clinical results for patients with flexion contractures who do not respond to conventional treatment modalities. This approach offers an alternative regimen that can be incorporated into rehabilitation protocols for the treatment of knee flexion contractures after TKA.

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