Title

A Successful Implant of Peripheral Nerve Stimulation of the Right Saphenous for Chronic Post-Surgical Knee Pain Following Total Knee Arthroplasty: A Case Report

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Introduction

Total knee arthroplasty (TKA) is commonly done to relieve chronic knee pain (KP) caused by moderate-severe osteoarthritis (OA). The number of annual TKAs in Medicare patients has increased by 162% from 93,230 to 243,802 between 1991 and 2010. Although TKAs are successful in reducing KP, a considerable number of patients experience chronic postsurgical pain (CPSP). Recent reports have shown that peripheral nerve stimulation (PNS) is successful in treating several pain conditions. This report presents a case of a successful PNS implant in a patient with refractory CPSP of the right knee (RK) following TKA and right genicular radiofrequency ablation (GRFA).

Case Presentation

A 79-year-old man with two right knee meniscus surgeries and right TKA in 2018 for severe OA presented with CPSP of the RK post-TKA. He reported pain at the superior medial aspect of the RK, rated 8/10 on the Numerical Rating Scale (NRS), exacerbated by ambulating, and improved with icing and elevation. Physical examination was significant for tenderness to palpation of the medial joint line of the RK. Initial treatment involved GRFA, including the suprapatellar branch under fluoroscopy, without relief. Thus, a trial of PNS (SPRINT® PNS System, SPR Therapeutics, Inc., Cleveland, OH, USA) targeting the saphenous nerve (SN) under ultrasound guidance (UG) was done, leading to 100% pain relief at one month. The patient eventually was scheduled for a permanent PNS implant (Nalu™ Neurostimulation System, Nalu Medical, CA, USA) for the right SN under UG.

Material and Methods

The patient's battery site, needle entry, and implantable pulse generator (IPG) sites were pre-operatively marked on the patient's right lower extremity. External (right anterior superior iliac spine and right patella base) and internal landmarks (right femoral artery, right sartorius muscle, right vastus medialis muscle, and right adductor longus muscle) were identified. A 15 Hz linear transducer probe was positioned on the right thigh, medial to the line between the landmarks. A percutaneous sleeve and stimulating probe lead system were assembled and inserted under UG while avoiding the femoral artery. The introducer needle was placed between the right sartorius and vastus medialis muscles, beneath the saphenous nerve, and lateral to the right femoral artery. Subsequently, the needle was replaced with a lead at the identical location. Stimulation parameters were optimized to induce saphenous nerve stimulation, achieving paresthesia overlapping the patient's right knee pain region. The lead position was modified until the desired paresthesia was attained. Post-verification of electrical continuity and desired responses, the lead

was secured, and the entry point was sutured. The lead was tunneled to the IPG implant site, where a pocket for the IPG was created. Upon securing the IPG and verifying optimal lead impedance, incisions were sutured and sealed with Dermabond, dressed, and covered.

Result
The patient experienced 100% pain relief at the 3-week follow-up.

Conclusion/Discussion
PNS is an effective procedure for treating chronic pain, including CPSP. The SN is one of several nerves innervating the knee and provides sensory innervation to the anteromedial and inferomedial regions of the knee joint. PNS's precise mechanism of pain relief for CPSP post-TKA remains unclear. While our case report demonstrates the efficacy of UG PNS implant for refractory CPSP post-TKA, future research should focus on larger randomized controlled trials to establish the efficacy and safety of PNS for this population. Investigating potential mechanisms of action of PNS in this group could provide valuable insights into their underlying pathophysiology and inform the development of novel PNS-based treatment modalities. In conclusion, our successful implant demonstrates the potential benefit of using PNS for prolonged and sustained pain relief in refractory CPSP post-TKA.

Informed Consent
The patient was informed and consented to be published in the case report. This is IRB-exempt per Baylor College of Medicine's institutional policy.

Conflicts Of Interest
There is no conflict of interest among the authors.

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