



## Augmenting conventional regional nerve block with peripheral neuromodulation using a perineural stimulating catheter

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### To the Editor,

Percutaneous peripheral nerve stimulation (PNS) is increasingly being used in acute pain management.<sup>1,2</sup> With written informed consent, we report a case of using PNS via a stimulating peripheral nerve catheter and nerve stimulator to perform regional nerve blocks for the control of refractory postoperative pain.

An 80-yr-old female underwent right hip hardware removal followed by a hip arthroplasty. She had a history of fibromyalgia and chronic back pain requiring long-term hydromorphone (72 mg·day<sup>-1</sup> and gabapentin. Despite utilizing a postoperative right femoral nerve block and 132 mg hydromorphone on the first postoperative day (POD), she became increasingly drowsy and was immobilized because of severe pain (Figure). Inspired by previous reports showing the analgesic benefit of a short duration of PNS followed by local anesthetic injection,<sup>3</sup> we adapted a similar approach for this case after discussion with the patient. Under ultrasound-guidance, a non-stimulating femoral nerve catheter was replaced with a stimulating catheter (StimuLong Sono Tsui, Pajunk, Germany). The catheter was sited deep to the femoral nerve with its position confirmed by hydrodissection (1 mL dextrose 5%).

A nerve stimulator (Multistim SENSOR, Pajunk, Germany) was initially connected to the stimulating catheter (pulse width: 0.1 msec; frequency: 2 Hz; current 0.3 mA) with no noticeable improvement. When the current was increased to 0.5 mA, a warm feeling was reported, and pain intensity was reduced from the hip to the knee without any motor response. Stimulation was continued for 50 min resulting in a reduction of the numeric pain score from 10 to 6. Upon termination of stimulation, a loading dose of 10 mL mixture of 0.5% ropivacaine and 0.125% bupivacaine (1:1) was injected and followed by 0.2% ropivacaine infusion at 6 mL/hr. Ninety minutes later, the patient sat up and was satisfied with her pain control. A 30% reduction of opioid consumption was observed over the next 24 hr, which continued to decline (despite the femoral catheter being dislodged inadvertently the following day). On POD 14, the patient was discharged home on her same preoperative daily dose of 72 mg hydromorphone.

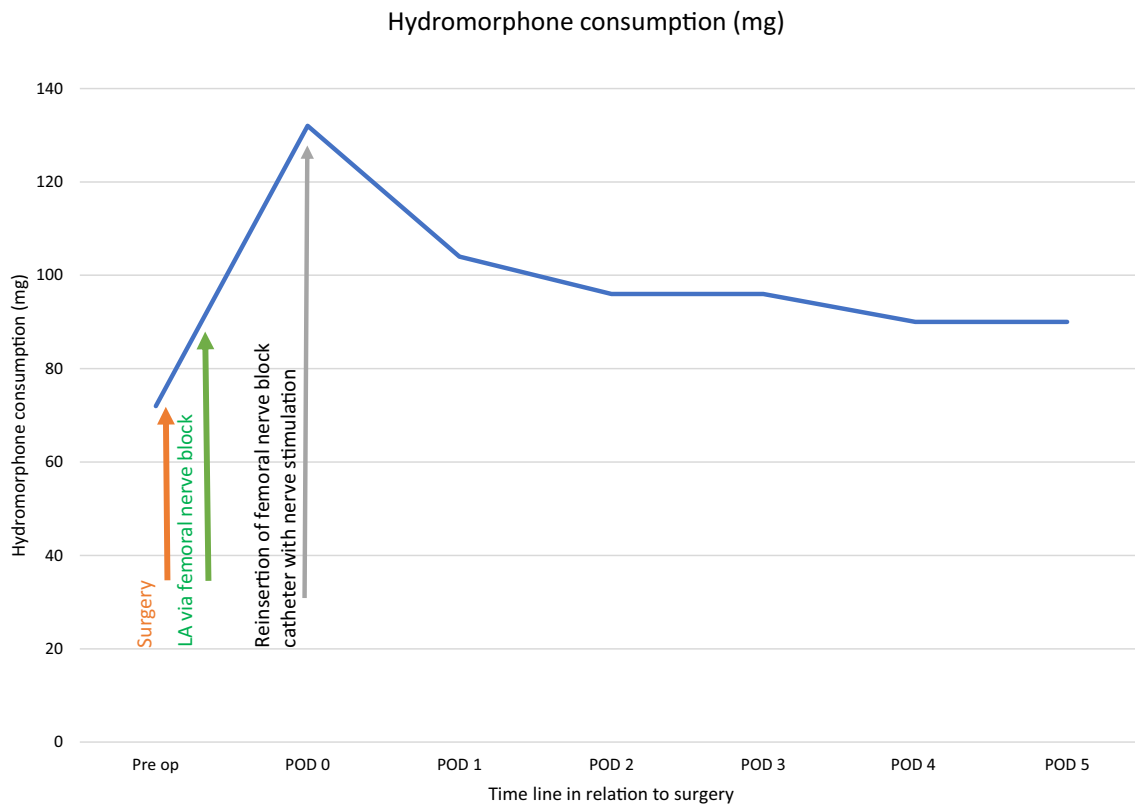
This case illustrates the concept of utilizing a stimulating catheter designed for peripheral nerve blockade to facilitate both PNS and local anesthetic administration for analgesia purposes. While the exact mechanism and optimal neuromodulation properties (i.e., frequency, pulse width amplitude, and stimulation duration) remain uncertain, the low frequency and amplitude settings used in this case were comparable to the previously reported successful neural modulation.<sup>3</sup> Beyond analgesic effects, similar brief neuro-stimulation has also been shown to produce a long-term benefit in enhancing sensory reinnervation.<sup>4</sup> This case also resembles the scenario of analgesic effects from low frequency transcutaneous electrical nerve stimulation even when stimulating electrodes are applied distally and remotely from the pain-affected site.<sup>5</sup> Hence, rather than analgesic

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**FIGURE** Figure showing hydromorphone consumption on different postoperative days with the events in relation to femoral nerve block insertion and nerve stimulation. Hydromorphone consumption rapidly reduced after the activation of nerve stimulation, and continued to improve even after the cessation of nerve stimulation. Thus, the

effect following the nerve conduction principle where interruption of nerve conduction occurs, we also speculate that a possible analgesic mechanism could be due to a “gate-control theory”-related mechanism where the dorsal horns of the spinal cord serve as a gate that inhibits or facilitates transmission from the periphery to the brain.<sup>5</sup> Pain transmission from unblocked nerves innervating the surgical site still integrate within the spinal cord; therefore, activating the gate through stimulation of unblocked nerve fibres in the femoral nerve seems a plausible mechanism. This case shows that using a readily available stimulating catheter and nerve block stimulator is a feasible way to augment pain control with neuromodulation in acute pain.

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reasoning for subsequent opioid reduction remains uncertain for which might be the effect of the local anesthetic, stimulation or both. POD = postoperative day; Post-op = postoperative; LA = local anesthetic.

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