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# Utility of Perfusion Index for Objective Assessment of Successful Lumbar Sympathetic Block: A Case Report

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**Background:** The clinical endpoints considered to define a successful block are reduction in pain, warmer lower extremities, increased blood flow, and disappearance of sweating. However, in the perioperative setting, existing measures to define sympathetic block success are sparse and lack sensitivity and objectivity. Perfusion index (PI) represents a noninvasive and continuous measurement of peripheral perfusion and is a ratio of the pulsatile blood flow to the nonpulsatile or static blood in peripheral tissues measured by plethysmography.

**Case Report:** We present a case of a 35-year-old man who had a history of multiple fractures in lower limbs and who presented with complex regional pain syndrome of the right lower limb. PI was used as a marker of sympathetic block in order to objectify the block. The PI on the blocked side increased continuously compared to the nonblocked side. The patient also had significant pain relief on the side of the block.

**Conclusion:** We believe that plethysmography-based PI can be utilized as an efficient objective tool to confirm a successful sympathectomy as demonstrated in this case of diagnostic lumbar sympathetic block.

**Key words:** Complex regional pain syndrome (CRPS), lumbar sympathetic block, perfusion index (PI).

## BACKGROUND

Lumbar sympathetic block provides a diagnostic and therapeutic potential for lower limb complex regional pain syndrome (CRPS). There are various tests for assessing sympathetic blockade; however, in clinical practice, none of these methods are used regularly. Temperature change and pain or symptom relief are being used more commonly than other methods for the assessment of successful sympathetic block. In previous studies, perfusion index (PI) has been reported as a tool to measure the efficacy of stellate ganglion block (1). However, to our knowledge, the utility of PI for assessment of lumbar sympathetic block has not been reported to date. Here, we report a case in which PI was used as an objective tool along with conventional signs such as a change in temperature and alleviation of pain to assess the efficacy of successful diagnostic lumbar sympathetic block in a patient with suspected lower limb CRPS.

Written informed consent from the patient was obtained for publishing this case report.

## CASE

A 35-year-old entrepreneur who used a wheelchair for one year after a traumatic fracture of the left tibia-fibula and distal femur underwent multiple surgeries over the last year and was suspected to have lower limb CRPS. The patient had pain and allodynia in all 4 limbs. The intensity of pain was maximum in the right lower leg and hence it was decided to administer a diagnostic right lumbar sympathetic block under fluoroscopic guidance. In the preoperative area

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baseline vitals and PI were recorded. Once the patient was shifted to the procedure room after confirming the World Health Organization safety checklist, he was placed in a prone position with bolsters and standard American Society of Anesthesiologists monitors were connected. A pulse oximetry probe capable of displaying the PI (Beneview T8, Mindray, China) was placed on the right and left great toes. Under all aseptic precautions and fluoroscopic guidance, L2-L4 vertebral bodies were identified in the anteroposterior view and a 22-gauge, 150-mm Quincke needle was introduced at the level of the L3 vertebral body in oblique view. Thereafter, depth was confirmed by a lateral view and a radiocontrast dye (1-2 mL) was injected to rule out any inadvertent neuraxial or vascular placement. A diagnostic lumbar sympathetic block was given with 8 mL of 0.2% ropivacaine. Soon thereafter a sequential and continuous increase in PI on the blocked (right) side was noted while it continued to remain close to the baseline value (Fig. 1). Also, a temperature rise was noted in the right leg by 3 degrees. There was no significant change in hemodynamics during or after the procedure. Post procedure the patient was shifted to the postanaesthesia care unit and the PI was measured until 25 minutes post procedure, which showed a persistently high PI in the right lower limb, with initial PI and final PI values in the right and left lower limbs being 0.53/12.52 and 0.58/1.54, respectively (Fig. 1). The patient reported a reduction in allodynia and about 80% pain relief in the right leg.

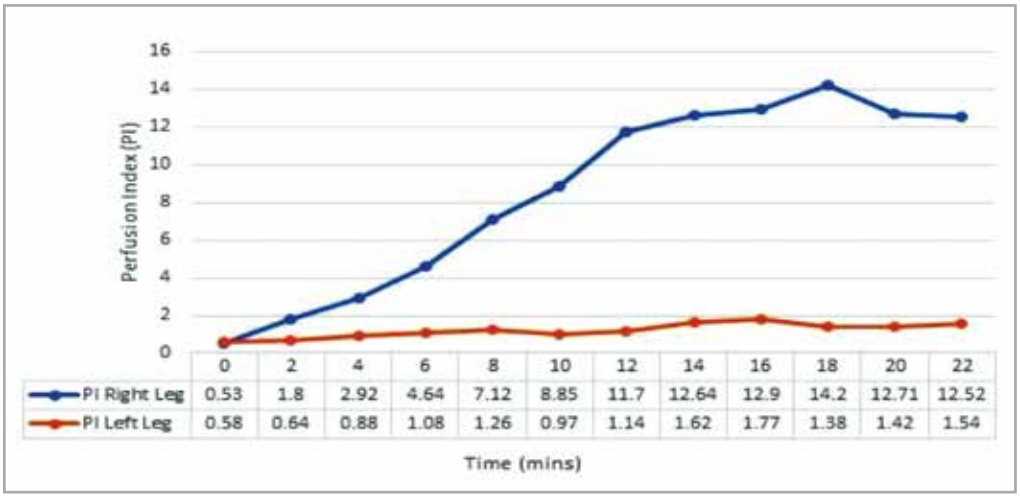


Fig. 1. Trend of Perfusion Index in Right and Left Lower Limb.

## DISCUSSION

Lumbar sympathectomy, by virtue of its interruption of the sympathetic system ($\alpha$1-receptors blockade) of the lower limb, leads to vasodilation and augments the flow of microcirculation (2). The confirmation of the success of the sympathetic block is usually done by resolution of symptoms, such as reduced nociception and decreased sweating, and clinically by assessing the rise of local temperature (3). All these signs lack a sense of objectivity. The other sophisticated tests such as laser doppler flow have been used intraoperatively to identify successful thoracic sympathectomy (4). However, this may not be readily available. Measurement of increase in temperature (1-3 degrees) on the blocked side has been advocated as one of the standards and feasible methods to detect the efficacy of sympathectomy; however, it lacks in precision and sensitivity when compared to infrared and liquid crystal thermography techniques (3). Other tests like skin conductance response, various sweat tests, skin plethysmography, increase in blood flow by xenon (Xe133) clearance, laser doppler flowmetry, pulse wave, size of the ulcer, distal perfusion pressure, capillary oxygen tension, venous oxygen tension, saturation, and muscle metabolism, etc. are reported for the assessment of sympathetic blockade (3) but are often cumbersome and not universally available. Most plethysmography devices these days in modern operating rooms are equipped to show the PI. PI represents a noninvasive measure of peripheral perfusion that can be continuously and noninvasively obtained from a pulse oximeter. The ability to trend the PI is critical; only the trend reveals the often-subtle changes in perfusion that are otherwise missed by static displays. These subtle changes captured by the trend provide immediate clinical feedback on the efficacy of anesthesia, analgesia, and/or therapeutic intervention (5). PI is calculated by

dividing the pulsatile signal (AC) by the nonpulsatile signal (DC) times 100 and is expressed as a percentage ranging from 0.02% to 20% (6). The size of the pulsatile portion increases with vasodilation and decreases with vasoconstriction; thus changes in PI reflect changes in peripheral blood flow. A higher PI value indicates a stronger pulsatile signal and better peripheral circulation at the sensor site. An increase in PI generally indicates an increase in peripheral blood flow as occurs in a sympathetic blockade of the respective area. After a sympathetic block, vasodilation leads to redistribution of blood flow to the skin and subcutaneous tissues improving circulation and increasing temperature. Changes in the PI are related to changes in peripheral microcirculation, and these are correlated with vascular status, sympathetic reactions, and function of the circulatory system (7). The ability of PI to pick up subtle changes in microcirculation has been reported in clinical practice for confirmation of thoracic sympathectomy (4), stellate ganglion block (1), epidural (8), and brachial plexus block (9). Hence, we believe PI can be a useful objective tool for assessment of lumbar and other sympathetic blocks; however, its validity must still be established with more randomized trials.

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