

TECHNOLOGY UPDATE:

Sciatic nerve block: A useful procedure for diabetic foot surgery

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The range of comorbidities experienced by people who require lower-limb surgery to manage diabetic foot disease are many. These comorbidities make the undertaking of general anaesthesia both difficult and places them at high risk of complications during surgery or in the immediate postoperative period. In this article the authors present a description of a peripheral nerve block procedure as an alternative to general anaesthesia in patients undergoing lower-limb surgery. Two case reports are also presented.

People with diabetic foot disease regularly have severe comorbidities resulting in a high-risk profile for anaesthesia.^[1,2] General anaesthesia and neuroaxial blockade (e.g. spinal anaesthesia) may impair hemodynamic stability. In people with diabetes who require podiatric surgery, peripheral nerve blocks targeting at the sciatic nerve may be a useful alternative to general anaesthesia.^[3,4]

The authors provide a detailed description of the sciatic nerve block technique, and two case reports.

PRACTICAL PROCEDURE

While in supine position, the sciatic nerve is identified by electric nerve stimulation through a lateral approach with an insulated needle being inserted at the middle of the patients' thigh [FIGURE 1]. The correct position of the needle (we use NanoLine 22 g × 80 mm; Pajunk®, Germany) is confirmed by electric nerve stimulation. The electrical nerve stimulator (we use Stimuplex HNS 11®; Braun, Germany) produces an electrical current that depolarises the nerve membrane and causes contraction of the effector muscles of the relevant area. This confirms the proximity of the needle to the nerve. Foot flexion at 0.1 ms and 0.4 mA indicates adequate motor response and 40 mL of local anaesthetic (e.g. ropivacaine 0.5% or lidocaine 1.5%) are injected. If technical

equipment and expertise are present, the sciatic nerve may also be localised by ultrasound.

Some regions of the lower leg belong to the saphenous nerve, which is the terminal branch of the femoral nerve. In order to achieve complete anaesthesia of the lower leg, this nerve has to be blocked by additional 10 mL of local anaesthetic (e.g. ropivacaine 0.5% or lidocaine 1.5%). Because the saphenous nerve only consists of sensory fibres, electric nerve stimulation may result in painful paraesthesia and is counterproductive. It is sufficient to inject into the subcutaneous wall reaching from the tuberositas tibiae to the medial caput of the gastrocnemius muscle [FIGURE 2]. However, the saphenous nerve can also be identified by ultrasound. Sufficient surgical anaesthesia is achieved 10–15 minutes after completion of injection. Characteristics of

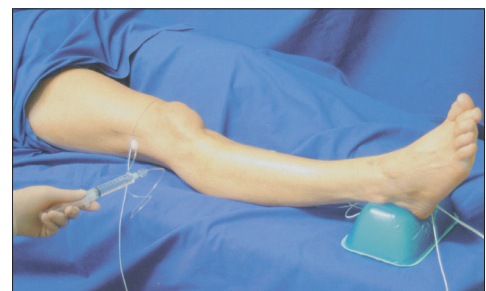
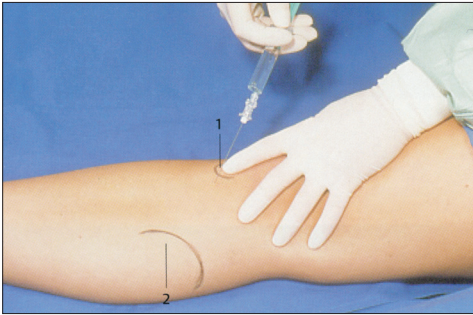


Figure 1. Patient position and needle insertion for a sciatic nerve block.

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Figure 2. The saphenous nerve is blocked by injecting a subcutaneous wall from the tuberositas tibia [1] to the medial caput of the gastrocnemius muscle [2].



the block are related to the type of local anaesthetic used; lidocaine blocks have a fast onset and last from 2 to 3 hours, while ropivacaine blocks have a slower onset but regularly last >10 hours.^[5] It is therefore suggested that lidocaine and ropivacaine be combined to achieve both fast onset and a long duration. With a sufficient block, additional postoperative pain control can usually be dispensed with.

Using this block technique does not impair the patient's protective reflexes (e.g. coughing, swallowing), meaning that there is no need for postoperative fasting and, for this reason, may make inpatient glycaemic control more manageable.

CASE STUDIES

As outlined before, diabetic patients regularly suffer from severe comorbidities, which contribute to a high risk profile according to American Society of Anesthesiologists patient classification status III (severe systemic disease – i.e. definite functional impairment [e.g. diabetes and angina with relatively stable disease, but requiring therapy]) or IV (severe systemic disease that is a constant threat to life [e.g. diabetes and angina and chronic heart failure; patient has dyspnea on mild exertion and chest pain]).^[6]

Hence, surgical procedures to manage diabetic foot disease should be undertaken with a careful consideration of the anaesthetic techniques available. Regrettably, there is a widely held belief – among both patients and healthcare professionals – that all surgical procedures require general anaesthesia. In the authors' practice, the nerve block anaesthesia described above has proven a useful addition to the management of some patients

requiring surgery to manage diabetic foot disease. The following case reports illustrate the benefits of peripheral nerve blocks in this patient group.

Case 1

A 72-year-old man was scheduled for below-knee amputation due to infected diabetic foot ulceration. The patient had long-standing insulin-dependent diabetes (IDDM), renal insufficiency and severe coronary artery disease. He had a history of myocardial infarction during a femoro–popliteal bypass surgery, which led to intraoperative cardiopulmonary resuscitation. Given the patient's history general anaesthesia was not recommended. Due to absolute arrhythmia associated with atrial fibrillation, he was anticoagulated with high-dose enoxaparin and therefore spinal anaesthesia was contraindicated.

Following discussion, the patient consented to regional anaesthesia and the authors' team blocked the sciatic and the saphenous nerve as described above. Beside light sedation with 0.5 mg of midazolam he received no other systemic substance.

The surgery was uneventful with a heart rate between 60 and 80 beats/min and a noninvasive blood pressure of 130/60 mmHg throughout. Postoperatively the patient was transferred to his normal ward to take lunch.

At 1-year follow-up the patient was doing well, with no major documented events.

Case 2

A 77-year-old man with a history of long-standing IDDM, renal insufficiency and arterial hypertension, was scheduled for forefoot amputation due to infected diabetic foot ulceration. The patient's left ventricular ejection fraction was significantly reduced (15%). Spinal anaesthesia (with possibly deleterious preload reduction) and general anaesthesia (with possibly hazardous positive-pressure ventilation) seemed unfavourable interventions.

The patient consented to a regional anaesthesia and the authors' team undertook the block described previously. Again, beside moderate intravenous sedation during the blocking procedure with midazolam and sufentanil (1 mg and 0.01 mg, respectively) no additional systemic medication was required. Surgery was uneventful, heart-rate ranged between 75 and 85 beats/min; blood pressure was stable at 130/80 mmHg.

“Surgical procedures to manage diabetic foot disease should be undertaken with a careful consideration of the anaesthetic techniques available.”

“The authors’ experience indicates that people with diabetes may benefit from peripheral nerve blocks for surgical procedures of the lower leg.”

Following the amputation, the patient was transferred to his normal ward.

At 1-year follow-up the patient was doing well, with no major documented events.

DISCUSSION

The authors’ experience indicates that people with diabetes may benefit from peripheral nerve blocks for surgical procedures of the lower leg. The authors’ experience corresponds with previous investigations.^[7,8] Avoiding general anaesthesia in this population may be a central concern, and improve short-term outcomes following lower-limb surgery.

As long-standing diabetes impairs various body systems, these patients have low reserves to preserve against additional straining factors during general anaesthesia.^[9,10] This includes:

- Preserving cardiopulmonary integrity, which is negatively influenced by positive-pressure ventilation during general anaesthesia.^[11]
- Negating the need for anaesthetic agents that reduce vascular tone and increase the need for vasopressive substances, which may impair capillary blood flow.
- Insufficient metabolic and excretory capacities may cause extended effects of muscle relaxants, inhalants and opioids, thereby impairing the early postoperative recovery period.^[12] The latter two additionally reduce the integrity of the immune system.^[13] Combinations of these factors are suspected to be responsible for increased pulmonary complications in people with diabetes.^[14]

With the use of peripheral blocks, the drawbacks of general anaesthesia are not only avoided, but additional benefits added:

- By contrast to signal transduction under general anaesthesia, blocking a peripheral nerve means that afferent signals are stopped before they cause efferent endocrine stress responses.^[15]
- Patients do not require postoperative fasting, so that continued oral medication and nutrition may help in preserving blood glucose homeostasis during this vulnerable period.^[16]

CONCLUSION

Healthcare professionals who are involved in surgical procedures of the lower limbs in vulnerable patients with diabetes may consider the use of peripheral nerve block

in instead of general anaesthesia, in those in whom it is appropriate. ■

REFERENCES

1. American Diabetes Association (2003) Peripheral arterial disease in people with diabetes. *Diabetes Care* 26(12): 3333–41
2. Prompers L, Huijberts M, Apelqvist J et al (2007) High prevalence of ischaemia, infection and serious comorbidity in patients with diabetic foot disease in Europe. Baseline results from the Eurodiale study. *Diabetologia* 50(1): 18–25
3. Horlocker TT, Wedel DJ, Benzon H et al (2003) Regional anesthesia in the anticoagulated patient: defining the risks (the second ASRA Consensus Conference on Neuraxial Anesthesia and Anticoagulation). *Reg Anesth Pain Med* 28(3): 172–97
4. Kocum A, Turkoz A, Bozdogan N et al (2010) Femoral and sciatic nerve block with 0.25% bupivacaine for surgical management of diabetic foot syndrome: an anesthetic technique for high-risk patients with diabetic nephropathy. *J Clin Anesth* 22(5): 363–6
5. Heavner JE (2007) Local anesthetics. *Curr Opin Anaesthesiol* 20(4): 336–42
6. American Society of Anesthesiologists (2012) *ASA Physical Status Classification System*. Available from: <http://bit.ly/l3B2V2> (accessed 09.08.2012)
7. Chia N, Low TC, Poon KH (2002) Peripheral nerve blocks for lower limb surgery—a choice anaesthetic technique for patients with a recent myocardial infarction? *Singapore Med J* 43(11): 583–6
8. Raith C, Kölblinger C, Walch H (2008) [Combined transgluteal ischial and femoral nerve block: retrospective data on 65 risk patients with leg amputation]. *Anaesthesist* 57(6): 555–61 [Article in German]
9. Chance WW, Rhee C, Yilmaz C et al (2008) Diminished alveolar microvascular reserves in type 2 diabetes reflect systemic microangiopathy. *Diabetes Care* 31(8): 1596–601
10. Faglia E, Clerici G, Clerissi J et al (2009) Long-term prognosis of diabetic patients with critical limb ischemia: a population-based cohort study. *Diabetes Care* 32(5): 822–7
11. Pinsky MR (1994) Heart-lung interactions during positive-pressure ventilation. *New Horiz* 2(4): 443–56
12. Bower WF, Jin L, Underwood MJ et al (2010) Overt diabetes mellitus adversely affects surgical outcomes of noncardiovascular patients. *Surgery* 147(5): 670–5
13. Brand JM, Kirchner H, Poppe C, Schmucker P (1997) The effects of general anesthesia on human peripheral immune cell distribution and cytokine production. *Clin Immunol Immunopathol* 83(2): 190–4
14. Morriconi L, Ranucci M, Denti S et al (1999) Diabetes and complications after cardiac surgery: comparison with a non-diabetic population. *Acta Diabetol* 36(1–2): 77–84
15. Kehlet H (1998) Modification of responses to surgery by neural blockade: clinical implications, neural blockade. In: Cousins MJ (ed.) *Clinical Anesthesia and Management of Pain* (3rd edn). Lippincott–Raven, Bridenbaugh, PO: 129–78
16. McCavert M, Mone F, Dooher M et al (2010) Perioperative blood glucose management in general surgery – a potential element for improved diabetic patient outcomes – an observational cohort study. *Int J Surg* 8(6): 494–8