

Ultrasound-guided Saphenous Nerve Block for Saphenous Neuralgia after Knee Surgery: Two Case Reports and Review of Literature

Abstract

Saphenous neuralgia is characterized by persistent neuropathic pain at the distribution of the saphenous nerve. Injury to the saphenous nerve, and specifically to its infrapatellar branch of the saphenous nerve has been implicated as a cause of medial knee pain after orthopedic knee surgery or trauma. We present two cases of saphenous neuralgia, one after total knee arthroplasty and the other after anterior cruciate ligament reconstruction, that were adequately treated with ultrasound-guided saphenous nerve blocks distal to the adductor canal. Early recognition and treatment of saphenous neuralgia is essential to prevent persistent disabling pain, which significantly affects patients' quality of life.

Keywords: Knee, neuralgia, pain

Introduction

Saphenous neuralgia is characterized by persistent neuropathic pain at the distribution of the saphenous nerve.¹ Total knee arthroplasty (TKA), anterior cruciate ligament (ACL) reconstruction, knee arthroscopy, tibial intramedullary nailing, and knee trauma, may all be complicated by saphenous nerve injury and especially the infrapatellar branch of the saphenous nerve (IPSN).¹⁻⁴

Saphenous neuralgia must be included into the differential diagnosis of any persistent medial knee pain after knee surgery. Early diagnosis and prompt decision-making can obviate subsequent complications.¹

We present two cases of saphenous neuralgia, effectively treated with ultrasound-guided saphenous nerve blocks distal to the adductor canal. Both patients provided written informed consent for publication.

Cases Reports

Case 1

A 66-year-old woman presented with severe knee pain, persisting for 2 years after TKA, with initial Numeric Rating Scale (NRS) up to 10/10 at movement and 7/10 at rest at the knee area, with strong neuropathic

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characteristics, with Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) score 17/24. She described paroxysmic, burning pain, with the feeling of “pins and needles” over the knee. Clinical examination revealed allodynia, hyperalgesia, and hypoesthesia at the distribution of the saphenous nerve. After meticulous clinical and radiological examination, with normal laboratory tests and needle electromyography, any other potential etiologies of knee pain were excluded.

Diagnostic injection with 1% lidocaine at the site of maximum tenderness, at the knee scar, led to immediate but short-term relief. Alongside, a trial of systemic administration of gabapentin and duloxetine was commenced. Thereafter, an ultrasound-guided saphenous nerve block (linear 5–12MHz transducer/Vivid I; GE Healthcare, Waukesha, Wisconsin, USA) was conducted distal to the adductor canal, underneath the sartorius muscle.^{5,6} [Figure 1a and b]. Both, ropivacaine 0.375% and triamcinolone 20 mg were administered, producing a 50% pain relief. The patient responded favorably, with the pain symptoms further subsiding at 30%, to having a second saphenous nerve block 2 weeks later. One year post-treatment, the patient appears significantly better (NRS = 2/10), using only paracetamol as a rescue analgesic.

How to cite this article: Batistaki C, Saranteas T, Chloros G, Savvidou O. Ultrasound-guided saphenous nerve block for saphenous neuralgia after knee surgery: Two case reports and review of literature. *Indian J Orthop* 2019;53:208-12.

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Access this article online

Website: www.ijoonline.com

DOI: 10.4103/ortho.IJOrtho_520_17

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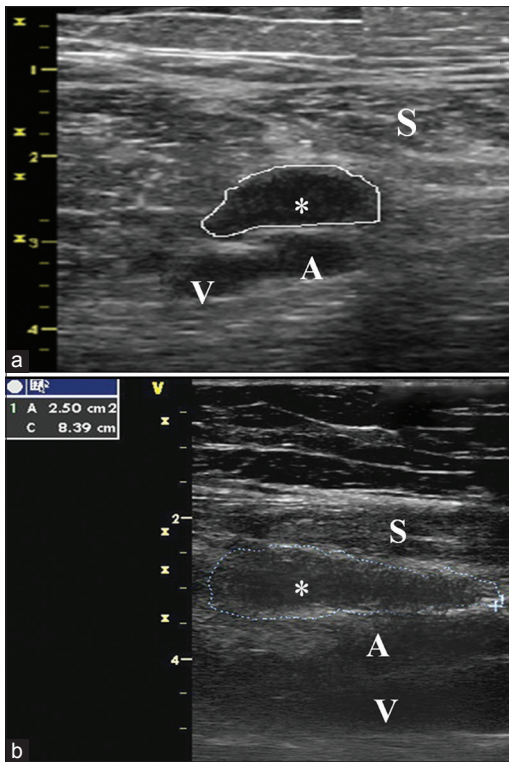


Figure 1: (a and b) Local anesthetic injection out of the subsartorial compartment for saphenous nerve block. The femoral artery (A) and vein (V) are seen below the sartorius (S). Local anesthetic injection is performed in the subsartorial compartment between the femoral artery and the sartorius muscle (S) Cross sectional (3A) and longitudinal (3B) view of the femoral artery, vein and local anesthetic spread area (*) are also shown

Case 2

A 34-year-old woman presented with severe knee pain, persisting for 18 months after ACL reconstruction, with initial NRS 6/10 and LANSS 19/24 over the distribution of the saphenous nerve. She had paroxysmic, burning pain, provoked by clothing, cold water, and touch, with severe allodynia and hyperalgesia. As before, all other causes of knee pain were excluded.

Diagnostic injection of 1% lidocaine was initially injected over the scar, and the subsequent 50% reduction of pain confirmed the diagnosis. An ultrasound-guided saphenous nerve block was performed with ropivacaine 0.375% and triamcinolone 20 mg. Three consecutive injections followed, with a lockout period of 2 weeks (two with corticosteroid). The pain was significantly reduced (NRS = 3/10), and the patient one year post-treatment experiences only sporadically paroxysmic pain, of low intensity.

Discussion

Saphenous neuralgia presents with a broad spectrum of symptoms, including sharp burning pain, hyperalgesia, allodynia, as well as hypoesthesia and dysesthesia at the distribution of the saphenous nerve.¹ A positive Tinel sign can facilitate the diagnosis. An extensive workup consisting of laboratory tests with inflammatory markers

and knee radiological imaging should be normal.¹ The use of specific diagnosing questionnaires such as LANSS and DN4 is helpful, to support the neuropathic pain diagnosis.^{1,6} The differential diagnosis is cumbersome, including tendonitis of the distal sartorius, pes anserinus bursitis, ligament pathology, knee joint pathology, peripheral vascular disease, lumbar nerve root compression, and other causes of peripheral neuropathic pain.^{1,6} Final diagnosis is achieved by symptomatic pain relief after injection of local anesthetic at the distribution of the saphenous nerve.^{1,7,8}

The rate of saphenous nerve injury, and especially of IPSN is approximately 21%–69%, after knee procedures^{1,9–15} [Table 1], implicating not only total TKA but also arthroscopic knee surgery.^{16,17} This is often related to inappropriate trocar/portal placement, or injury secondary to the use of a tourniquet.⁹ Surgical incisions at the medial part of the knee always entail a risk,^{9–15} especially midline incisions with medial parapatellar approach. Therefore, special care should be taken in such incisions if they cannot be avoided. In ACL reconstruction, this complication occurs frequently with both bone-patellar tendon-bone and hamstring autograft technique,¹² with an incidence ranging between 14.9% and 59%.² In this case, knee flexion and hip external rotation may reduce the tension applied on the nerve during harvesting of the semitendinosus and gracilis tendons and prevent postoperative saphenous neuralgia.¹⁴ Several authors have recommended the use of horizontal or oblique incisions instead of vertical ones, to expose the tibial insertions of the hamstring tendons, since with this technique there is less chance of infrapatellar saphenous nerve (IPS) injury.^{2,18} In a cadaveric study, where vertical incisions were used, the IPS was injured in 80% of the knees.^{19,20} However, there seems to be a safe zone to prevent saphenous nerve injury. Boon *et al.*¹⁹ in a cadaveric study stated that a safe area on the right knee may be at the tibial tuberosity plane, between 3.7 and 5.5 cm, with an angle of incision of 51.6°, and at the left knee was between 3.6 and 4.9 cm, with an angle of incision of 52.5°, respectively. Kartus *et al.*²⁰ in another cadaveric study described also this great variation of the IPS, and proposed two vertical 25 mm incisions for harvesting consistent bone-patellar tendon–bone autografts, leaving the IPS intact during the procedure. Other causes of damage include traction from medial retractors placed during surgery or adhesions which may develop between the injured nerve and adjacent fascial planes, resulting in neuritis.^{1,3,7} Some propose that in every case, smaller incisions minimize the possibility of nerve injury, in addition, with proper preparation of the nerve and cutting of the pulleys, which should be performed under direct visual control with a blunt technique. Finally, care should also be taken during anteromedial portal placement for ankle arthroscopy, or during lower leg fasciotomies, where the saphenous nerve may also be damaged along with the saphenous vein.²¹ However, in all cases, as described in multiple cadaveric

Table 1: Saphenous nerve injury after knee surgery

Reference	Surgical procedure	Incision	Outcome measure	Time postoperative	Result	Study type
Heare <i>et al.</i> , 2015	Intramedullary nailing of an open tibial shaft fracture	4 cm oblique scar at the junction between middle and distal anteromedial tibia, at the original open fracture site	Pain scores before and after selective anesthetic injection	1 year	Selective neurolysis and partial neurectomy, w/complete resolution of neuralgia and pain	Case report
Figueora <i>et al.</i> , 2015	Arthroscopic ACL (hamstrings)	Longitudinal, <25 mm, 50 mm from the medial articular margin, medial to the tibial tuberosity	Neurology consult 3 weeks after surgery, w/light touch and pinprick sensation exam and electrophysiology	3 weeks	Area of hypoesthesia in the IPSN territory in 17/22 knees; injury to IPSN el/cally detected in 15 patients; saphenous n. injury also in 2 patients	Case series (prospective)
Jameson and Emmerson, 2007	Arthroscopic ACL (hamstrings)	Longitudinal, 30 mm, over the pes anserinus	Questionnaire sent by post	13-78 months	LSCN: 29 patients (33%) SN: 23 patients (26%) IPSN: 10 patients (12%)	Case series (retrospective)
Liden <i>et al.</i> , 2007	Arthroscopic ACL (donor site issues in BTB vs. ST autograft)	BTB: 2 vertical 25 mm incisions; ST: 3 cm oblique over the pes anserinus	Clinical exam; pain assessment	7 years	Anterior knee pain in 39% of BTB group and 26% of ST group	RCT
Sanders <i>et al.</i> , 2007	Arthroscopic ACL (hamstrings)	2 cm longitudinal over pes anserinus	Patients questionnaire	Variable	SBSN: 14/62 or 23% IPSN: 12/62 or 19% Combined: 20/62 or 32%	Case series (retrospective), followed by cadaveric study to identify anatomic relations
Papastergiou <i>et al.</i> , 2006	Arthroscopic ACL (hamstrings)	3 cm vertical versus 3 cm horizontal incision for graft harvesting	Sensory exam for IPSN sensory changes	1-12 months	Vertical group: sensory changes in 46/116 patients or 39.7% Horizontal group: sensory changes in 17/114 patients or 14.9%	Case series (retrospective)
Portland <i>et al.</i> , 2005	Arthroscopic ACL (BTB)	Vertical versus horizontal incision for graft harvesting	Medical records review; patient questionnaire	At least 3 years	IPSN damage evidence in 20/34 patients or 59% in the vertical group; 18/42 patients or 43% in the horizontal group	Case series (retrospective)
Mochizuki <i>et al.</i> , 2004	Arthroscopic ACL (hamstrings)	Vertical incision	Patient questionnaire sent by post	32 months	47/86 (55%) reported sensory changes	Case series (retrospective)
Sgaglione <i>et al.</i> , 1990	Open ACL (hamstrings)	Medial parapatellar incision	Personal interview	24-81 months	IPSN numbness in 27/72 patients (38%); significantly bothersome in 1/72 patients (1.4%)	Case series (retrospective)
Bertram <i>et al.</i> , 2000	Arthroscopic ACL (hamstrings)	Vertical incision over the pes anserinus	Sensory exam	Immediately	SN neurolysis w/immediate resolution of symptoms	Case report

Contd...

Table 1: Contd...

Reference	Surgical procedure	Incision	Outcome measure	Time postoperative	Result	Study type
Kachar <i>et al.</i> , 2008	Total knee arthroplasty	Midline skin incision	11-point Numerical Rating Scale	21 months	SN neurolysis and neuroma resection w/resolution of symptoms	Case report
Leliveld <i>et al.</i> , 2012	Intramedullary nailing of the tibia	46 medial parapatellar; 26 transtendinous	SF-36; AKPS; study-specific questionnaire	Variable	IPSN deficit in 43/72 (60%); 12 nails removed due to knee pain; pain persisted in 7/12 patients	Case series (retrospective)

SN=Saphenous nerve, ACL=Anterior cruciate ligament, IPSN=Infrapatellar branch of the saphenous nerve, LSCN=Lateral sural cutaneous nerve, SBSN=Suprapatellar branch of the saphenous nerve, BTB=Bone-patellar tendon-bone graft, ST=Semitendinosus graft, SF-36=Short form-36, AKPS=Anterior knee pain scale, RCT=Randomized controlled trial

studies, there is a great variation in the course of IPS, and therefore, damage of the nerve cannot always be prevented.¹ Early identification of saphenous neuralgia and aggressive treatment are essential in alleviating patients' pain. Systemic drugs for the management of neuropathic pain, in addition to local anesthetic injections and capsaicin or lidocaine patches, have been proposed; with variable results.^{1,7} Injections of local anesthetic around saphenous nerve neuromas are diagnostic; however, it might be only with the ultrasound-guided saphenous nerve blocks that the pain relief is more persistent.^{1,7} However, the volume of the local anesthetic injected, the anatomic approach and the success rate of the block show a significant variability among studies.^{6,7} Clendenen *et al.*, showed ultrasound-guided injections of the IPS to be effective, with a response rate of 56.3%.⁷ In the adductor canal, the high anatomic variability of the saphenous nerve and the vessel sheath may result to incomplete spread of the local anesthetic, leading to the variable success rate of the block.⁶ In our cases, the saphenous nerve blocks were undertaken more distal to the adductor canal, providing significant pain reduction. Moreover, the vastus medialis nerve was not blocked avoiding the subsequent weakness of the corresponding muscle, which is important for immediate patient ambulation.⁶ To the best of our knowledge, there have been no clinical series or comparative trials discussing a technique similar to that used in this series. If the injection provides temporary comfort, there are multiple other options available, such as neurolysis, pulsed radiofrequency, cryoneuroablation, and surgical excision of neuroma, with the insertion of the proximal end into adjacent muscle.¹

Conclusion

Saphenous neuralgia can be a distressing condition leading to severe disabling pain. Prevention of saphenous nerve injury during knee procedures and high index of suspicion may help minimize its incidence. Saphenous nerve block should always feature at the armamentarium of our therapeutic options.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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