Case Report

Permanent Lesion of the Lateral Femoral Cutaneous Nerve after Low-Volume Ethanol 96% Application on the Lumbar Sympathetic Chain

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Lumbar sympathetic blocks and chemical sympathectomies are used for the pain treatment of peripheral arterial occlusive disease or sympathetically maintained pain syndrome after nerve injury or complex regional pain syndrome (CRPS). A 30-year-old patient was referred to the pain department with all the clinical signs and symptoms of a CRPS of the right foot one and a half years after being surgically treated for rupture of the achilles tendon. An inpatient admission was necessary due to insufficient pain reduction upon the current treatment, strong allodynia in the medial distal right lower leg and decreased load-bearing capacity of the right foot. A computed tomography (CT)-guided lumbar sympathetic block at the right L3 (Bupivacaine 0.5%, 4 mL) led to a skin temperature increase from 21°C before block to > 34°C for about 5 hours after the intervention. The patient experienced significant pain relief, indicating sympathetically maintained pain. Thus, we performed a CT-guided lumbar sympathetic neurolysis at the same level (ethanol 96%, 2 mL) 5 days later, achieving again a significant skin temperature increase of the right foot and a slight reduction of his pain intensity from numeric rating scale (NRS) 7 prior to the intervention to NRS 4 after 8 hours (NRS, 0 = no pain, 10 = strongest pain imaginable). Eight months later a repeated inpatient admission was necessary due to considerable pain relapse and decreased load-bearing capacity of his right foot. A CT-guided lumbar sympathetic neurolysis was repeated at the L4 level on the right side and was successful, inducing a significant skin temperature increase. Despite a temporary irritation of the genitofemoral nerve 8 hours after the intervention, a delayed irritation of the lateral femoral cutaneous nerve occurred. This was a long-lasting lesion of the lateral femoral cutaneous nerve following a CT-guided chemical sympathectomy with a low-volume ethanol 96% application - a complication which has not been described in literature until now. This is probably caused by broad dissemination of the neurolytic agent along the psoas muscle despite a correct needle position and spread of contrast agent. The development of this nerve injury even after injection of a small volume of ethanol (2 mL) may be delayed.

Key words: Complex regional pain syndrome, CRPS; sympathetically maintained pain syndrome, sympathectomy, neurolysis, lateral femoral cutaneous nerve, ethanol, complication, genitofemoral nerve

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Lumbar sympathetic blocks and chemical sympathectomies are used for the treatment of the pain of peripheral arterial occlusive disease or sympathetically maintained pain syndrome after nerve injury or complex regional pain syndrome (CRPS). Approximately 60% of the patients with symptomatic critical ischemia of the lower limbs and 44% of the patients with sympathetically maintained pain benefit from lumbar sympathectomies (1-3). The frequency and severity of the complications of chemical sympathectomy depends on the type of imaging (fluoroscopy > computed tomography [CT]) and

volume and kind of the neurolytic agent. Although they are rare, possible complications of CT-guided chemical sympathectomy are ureter stenosis, infections, bleeding and hematoma, and injury of the genitofemoral nerve. The latter is normally reversible (4).

We report a long-lasting lesion of the lateral femoral cutaneous nerve following a CT-guided chemical sympathectomy with a 2 mL low-volume ethanol 96% application - a rare complication which has been described only for large volume application (5).

Case Report

Medical History

A 30-year-old patient was referred to the pain department with all the clinical signs and symptoms suggestive of right foot CRPS in combination with enhanced bone metabolism in the late phase of a 99-m technetium-triple-phase-bone-scintigraphy one and a half years after being surgically treated for rupture of the achilles tendon. An inpatient admission was necessary due to insufficient pain reduction, strong allodynia in the medial distal right lower leg, and decreased load-bearing capacity of the right foot. The current medication on admission included a fixed oxycodone/naloxone combination (2 x 20/10 mg), pregabalin (2 x 150mg), and ibuprofen 600 mg prn.

Lumbar Sympathetic Blockade

A CT-guided lumbar sympathetic block at the right L3 (Bupivacaine 0.5%, 4 mL) led to a skin temperature increase from 21°C before the block to > 34°C for about 5 hours after the intervention. The patient experienced significant pain relief, indicating sympathetically maintained pain. Thus, we performed a CT-guided lumbar sympathetic neurolysis at the same level (ethanol 96%, 2 mL) 5 days later, achieving again a significant skin temperature increase of the right foot. The patient experienced a slight reduction of his pain intensity from numeric rating scale (NRS) 7 prior to the intervention to NRS 4 after 8 hours (NRS 0 = no pain, 10 = strongest pain imaginable). Additionally, the patient's load-bearing capacity increased and he could slightly better tolerate the desensitization treatment during the ergotherapy. This positive effect disappeared after one week. Thus, the lumbar sympathetic neurolysis was repeated at the right L4. A pain decrease from NRS 7 to NRS 4-5 was possible and the patient better tolerated wearing socks and shoes due to the combination of sympathetic blocks and the intensive physio- and ergotherapy. The patient was then dismissed from the inpatient department; therefore, the exact duration of the positive effect was not assessed.

Eight months later a repeated inpatient admission was necessary due to considerable pain relapse and decreased load-bearing capacity of his right foot. A ninhydrin test revealed an increased sweating in comparison with the other side, indicating the regeneration of sympathetic fibers. A CT-guided lumbar sympathetic neurolysis was repeated at the L4 level on the right side and was successful inducing a significant skin temperature increase (Fig. 1).

The position monitoring of the needle showed a correct dissemination of one mL of the contrast media ventral and lateral the spinal body and dorsal the vena cava inferior (Fig. 2).

At the beginning of the injection the patient reported a short and acute pain radiating in the right upper leg. No other disorders or complications occurred. Later during the same day the patient complained about dragging pain in the right inguinal area radiating to the testis, which disappeared during the same day, indicating temporary irritation of the genitofemoral nerve. Furthermore, the patient reported numbness in the right upper leg. The neurological examination revealed hypoesthesia corresponding to the supplying area of the lateral femoral cutaneous nerve which persisted. The proprioceptive reflexes were symmetric bilaterally. The further neurological examination was without any abnormal findings except for the existing clinical signs of CRPS in the right foot. The somatosensory evoked potentials (SSEP) after stimulation of the lateral femoral cutaneous nerves were absent on the right side, and were normal on the left side. The CT performed in the evening presented no abnormalities and no signs of internal bleeding. The magnetic resonance imaging (MRI) performed on the following day presented a small fluid film, which spread on the fascia of the psoas muscle reaching from the ventral to the dorsal part of the muscle (Figs. 3, 4).

The positive effects of the sympathetic neurolysis (pain decrease, better tolerating of wearing socks and shoes, increased load-bearing capacity) lasted for about 4-5 months.

Follow-up

Six months later the patient was seen in the outpatient clinic. The hypoesthesia of the upper leg corresponding to the supplying area of the lateral femoral cutaneous nerve persisted. The SSEP after stimulation

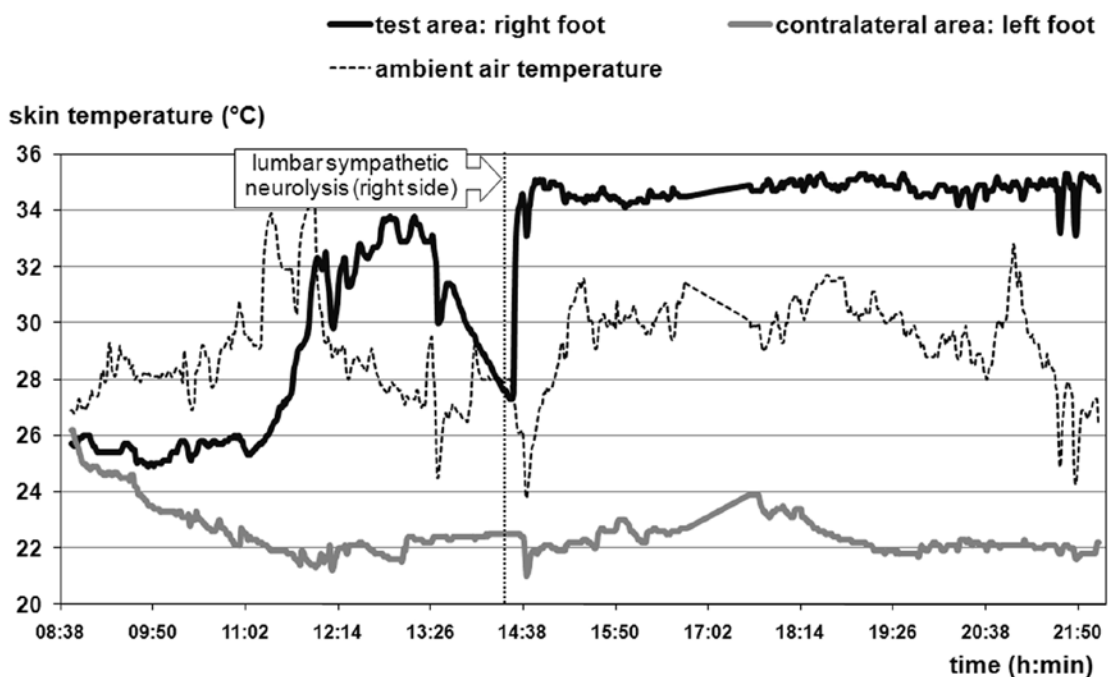

Fig. 1. *Skin temperature increased after lumbar sympathetic neurolysis with 2mL ethanol 96% at the right L4.*

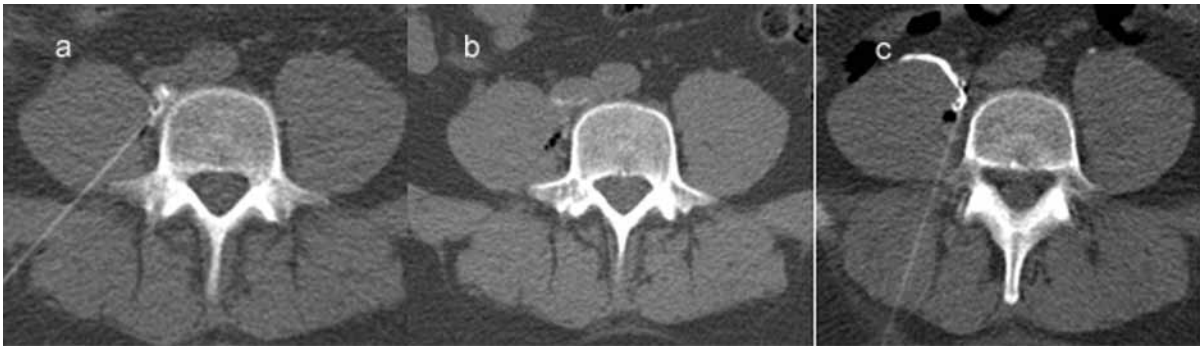

Fig. 2. *CT-guided lumbar sympathetic neurolysis at the right level L4 with 2 mL ethanol 96%. a: Position monitoring of the needle with one mL contrast media. Correct dissemination of the contrast media ventral and lateral the spine body and dorsal the vena cava inferior. b: Image at the same position after injection of 2 mL ethanol 96%. Correct dissemination of the fluid. The puncture channel is definable in the post interventional image. c: Another patient than described in this case report. A clear lateral malposition of the needle is seen, which induces a dissemination of contrast media along the ventral part of the psoas muscle.*

of the lateral femoral cutaneous nerve on the right side was present, but with significantly lower amplitude compared to the contra-lateral side. Furthermore, the patient reported again increased pain intensity up to NRS 8 as well as stronger dystonia in the affected extremity.

Due to repeated pain exacerbation, a spinal cord stimulation (SCS) system was implanted which led to significant pain decrease, reduction of the area with allodynia and its intensity, as well as better load-bearing capacity of the right foot. The follow-up visits confirmed the positive effects for about one year.

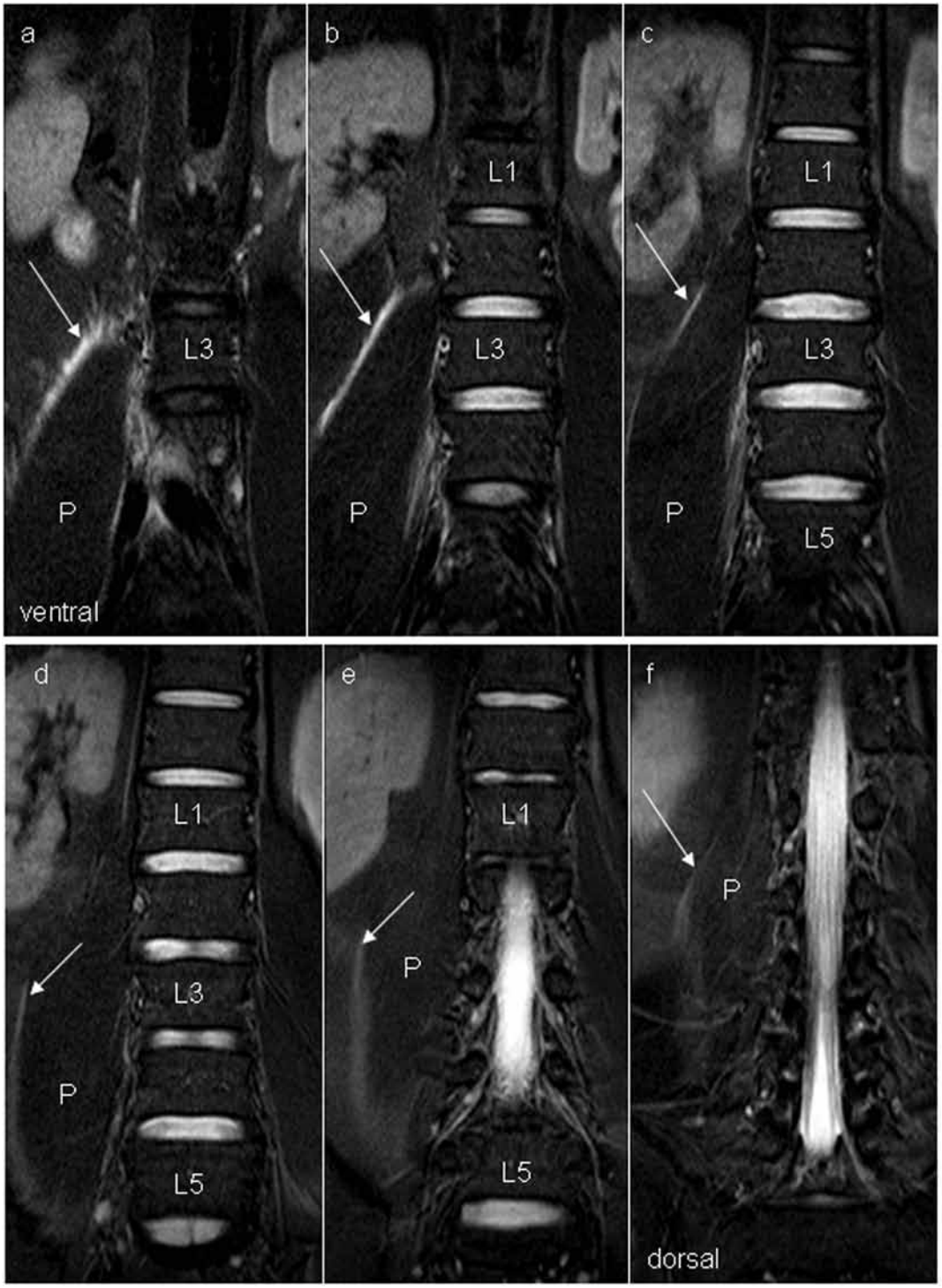

Fig. 3. *MRI: Coronar T2- STIR weighted images one day after lumbar sympathetic neurolysis with 2mL ethanol 96% at the right L4. A small fluid film spread on the fascia of the psoas muscle reaching from the ventral to the dorsal aspect of the muscle. a to f demonstrate aspects from ventral to dorsal lumbar spine. Arrows mark the fluid film. P = psoas muscle.*

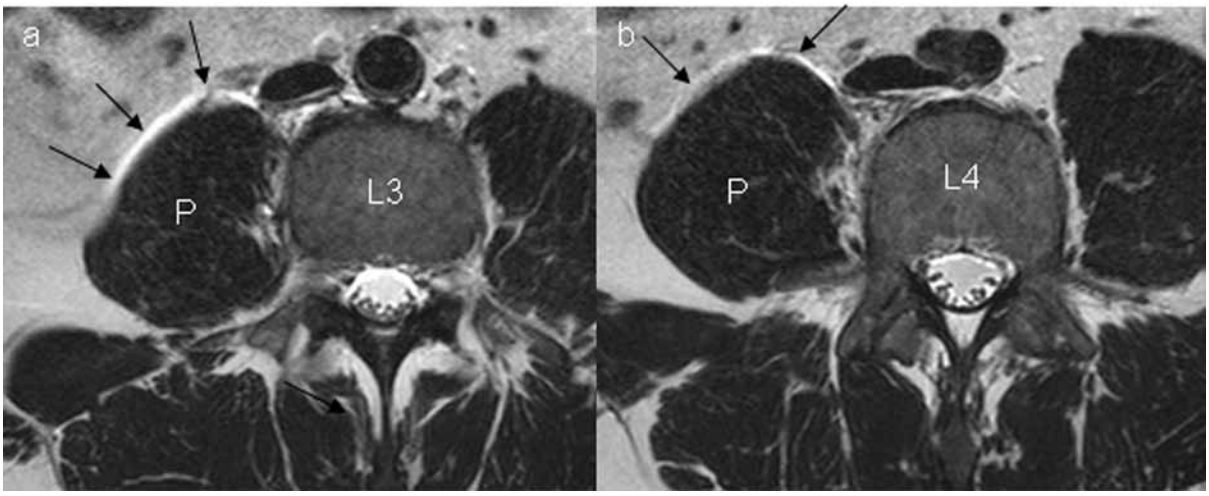

Fig. 4. *MRI: Transversal T2 weighted TSE at level L3 and L4 one day after the lumbar sympathetic neurolysis. Corresponding to Fig. 3 there is a small fluid film ventral and lateral the right psoas muscle. Arrows point to the fluid film. P = psoas muscle.*

Discussion

In this case report, we present a patient with permanent lesion of the lateral femoral cutaneous nerve after a primary successful lumbar chemical sympathectomy at L4. Initially the genitofemoral nerve was obviously affected, but recovered within 24 hours. Six months later the hypoesthesia in the supplying area of the lateral femoral cutaneous nerve was still present. The slight improvement of the SSEP 6 months later may be interpreted as initial nerve regeneration. To our knowledge, this is the first description of a long-lasting irritation of the lateral femoral cutaneous nerve after a chemical sympathectomy using a low volume of 2 mL ethanol.

A sympathectomy is a useful option in the management of several diseases. Indications for a lumbar sympathectomy could be critical leg ischemia (2,4) , sympathetically maintained pain (2,6), and hyperhydrosis (7).

Our clinical experience shows that in cases of incomplete or only short-lasting block of the sympathetic function after lumbar sympathetic neurolysis, a re-intervention on another lumbar level could increase the probability of complete neurolysis of the lumbar sympathetic chain and therefore achieve a better pain relief in cases of sympathetically maintained pain. Therefore as the effect of the CT-guided lumbar sympathetic neurolysis at the right L3 lasted only 8 hours, the procedure was repeated at the right L4 and achieved long-lasting clinical effects, enabling the physical and occupational therapy. After the clinical worsening 8 months later and the complication during the later performed sympathetic neurolysis, the treatment was escalated by implanting an SCS system. SCS has been reported to induce pain relief in patients with CRPS also for long-term treatment (8-11). The exact mechanisms of the SCS effect are still unclear. However, effects on the sympathetic nervous system have also been suggested (12). This aspect may explain also the clinical observations of positive effects in patients with previously diagnosed sympathetically maintained pain and was the rationale for the treatment escalation the present case.

The complication rate of sympathectomy depends on the approach. After surgical sympathectomy, a mortality rate of up to 9.6% has been reported. The use of fluoroscopic guidance greatly reduced the mortality rate. From 1970 to 1998 only 4 cases of death were described in the literature in association with this procedure. The CT-guided sympathectomy reduced the mortality rate almost to zero. Beyond mortality other complications are ureter lesions, which may result in ureter stenosis or occlusion with potential retention of urine. The latter occurs in approximately 1% (4). To avoid this complication, the intravenous injection of 20 mL of contrast media before intervention helps to identify the ureter to avoid accidental lesion. For the exact needle position in CT-guided sympathicolysis the anterior and medial border of the psoas muscle is favored as a landmark (13).

Other complications like infection, abscesses, bleeding, or hematoma are absolutely rare. For surgical sympathectomy nerve lesions have a probability of 11.9% (14). For chemical lumbar sympathethectomy the incidence for temporary genitofemoral nerve irritation is approximately 5-10% (15). Ohno et al (15) described, in a small study of 14 patients, an alternative transdiscal technique to avoid genitofemoral nerve lesions, arguing that the cause of the genitofemoral nerve lesions is a reflux of neurolytic agent through the puncture channel, damaging the genitofemoral nerve crossing the psoas muscle. A puncture through the lateral parts of the vertebral disc avoids the crossing of the psoas muscle, but bears the potential of other complications like discitis, nerve root injury, disc herniation, and accelerated disc degeneration (15). In our case we use the traditional approach. In the post-interventional images the puncture channel is definable and a small amount of air is seen without visible contrast media dissemination and also not around the psoas muscle. In the MRI on the following day, the puncture channel in the psoas muscle is not visible and there is no fluid within the muscle.

The 2 agents most commonly injected are 7% to 10% phenol and 50% to 100% ethanol (16). Phenol 10% induces a mild cytotoxic effect and ethanol 96% induces a moderate cytotoxic effect (17). Although there is no clear evidence, a higher complication rate of neuralgia is described when applying phenol for sympathectomy (18,19). Obviously ethanol is the more effective neurolytic agent. According to this we used only a small volume of 2 mL ethanol for chemical sympathectomy.

In the present case the nerve irritation are probably caused by the broad spread of neurolytic agent on the surface of the psoas muscle from the ventral to the dorsal aspect.

Therefore, we have to take a look at the course of the lateral cutaneous femoral nerve. The most commonly known description is that the nerve arrives at the lateral border of the psoas muscle. Not well known, but of importance, is the fact that the latter nerve has variable courses. The nerve might perforate the psoas muscle close to the genitofemoral nerve. Moreover nerve fibers can be exchanged with the genitofemoral nerve or the nerve can be entirely replaced by the genitofemoral nerve (20). As a consequence the agent does not need to spread all along the psoas muscle to its lateral border to hit the lateral cutaneous femoral nerve. Taking these variations into consideration, it might explain the presented case by an unlucky combination of lateral spread with a possible variation of the nerve's course.

Conclusion

A long-lasting irritation of the lateral femoral cutaneous nerve may occur as a rare complication even when a small volume of 2 mL ethanol is used. Previously this complication was only described after a large volume injection. The complication is probably caused by broad dissemination of the neurolytic agent along the psoas muscle despite a correct needle position and spread of the contrast agent. The development of this nerve irritation even after injection of a small volume of ethanol (2 mL) may be delayed.

References

1. Sanni A, Hamid A, Dunning J. Is sympathectomy of benefit in critical leg ischaemia not amenable to revascularisation? *Interact Cardiovasc Thorac Surg* 2005; 4:478-483.
2. Furlan AD, Lui PW, Mailis A. Chemical sympathectomy for neuropathic pain: Does it work? Case report and systematic literature review. *Clin J Pain* 2001; 17:327-336.
3. Day M. Sympathetic blocks: The evidence. *Pain Pract* 2008; 8:98-109.
4. Ernst S, Heindel W, Fischbach R, Gawenda M, Langen HJ, Neubauer S, Krahe T. Complications of CT guided lumbar sympathectomy: Our own experiences and literature review. *Rofo* 1998; 168:77-83.
5. Racz GB, Stanton-Hicks M. Lumbar and thoracic sympathetic radiofrequency lesioning in complex regional pain syndrome. *Pain Pract* 2002; 2:250-256.
6. Manjunath PS, Jayalakshmi TS, Dureja GP, Prevost AT. Management of lower limb complex regional pain syndrome type 1: An evaluation of percutaneous radiofrequency thermal lumbar sympathectomy versus phenol lumbar sympathetic neurolysis--a pilot study. *Anesth Analg* 2008; 106:647-649, table of contents.
7. Rieger R, Pedevilla S, Pochlauer S. Endoscopic lumbar sympathectomy for plantar hyperhidrosis. *Br J Surg* 2009; 96:1422-428.
8. Kumar K, Rizvi S, Bnurs SB. Spinal cord stimulation is effective in management of complex regional pain syndrome I: Fact or fiction. *Neurosurgery* 2011; 69:566-578.
9. van Eijs F, Geurts JW, Van Zundert J, Faber CG, Kessels AG, Joosten EA, van Kleef M. Spinal cord stimulation in complex regional pain syndrome type I of less than 12-month duration. *Neuromodulation* 2012; 15:144-150.
10. Geurts JW, Smits H, Kemler MA, Brunner F, Kessels AG, van Kleef M. Spinal

cord stimulation for complex regional pain syndrome type I: A prospective cohort study with long-term follow-up. *Neuromodulation* 2013 Jan 30. Epub ahead of print.

11. Prager JP. What does the mechanism of spinal cord stimulation tell us about complex regional pain syndrome? *Pain Med* 2010; 11:1278-1283.
12. Wu M, Linderoth B, Foreman RD. Putative mechanisms behind effects of spinal cord stimulation on vascular diseases: a review of experimental studies. *AutonNeurosci* 2008; 138:9-23.
13. Feigl GC, Kastner M, Ulz H, Breschan C, Pixner T, Dreu M, Umschaden HW, Likar R. The lumbar sympathetic trunk: Its visibility and distance to two anatomical landmarks. *Surg Radiol Anat* 2013; 35:99-106.
14. Furlan AD, Mailis A, Papagapiou M. Are we paying a high price for surgical sympathectomy? A systematic literature review of late complications. *J Pain* 2000; 1:245-257.
15. Ohno K, Oshita S. Transdiscal lumbar sympathetic block: A new technique for a chemical sympathectomy. *Anesth Analg* 1997; 85:1312-1316.
16. MacFarlane BV, Wright A, O'Callaghan J, Benson HA. Chronic neuropathic pain and its control by drugs. *Pharmacol Ther* 1997; 75:1-19.
17. Wang YC, Lee WH, Chen WY, Fu YM. Histopathological examination of chemo-sympathectomy in cats. *Neurol Res* 2000; 22:420-424.
18. Bonica JJ. *Clinical Applications of Diagnostic and Therapeutic Nerve Block.* Thomas, Springfield, 1979.
19. Thelen M, Günther RW. *Interventionelle Radiologie.* Thieme, Stuttgart, New York, 1999, p 369.
20. Lanz T, Wachsmuth W. Bein und Statik. In: Lanz T, Wachsmuth W (eds). P*raktische Anatomie.* 2nd ed. Springer, Berlin, Heidelberg, New York, 2003, p 73.