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Techniques in Vascular and Interventional Radiology

Lumbar Sympathetic Neurolysis: How to and When to Use?

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Lumbar sympathectomy was historically a mainstay of treatment for arterial occlusive disease and other vasospastic disorders, before the development of contemporary arterial reconstructive procedures either by surgical or endovascular means. Today, percutaneous methods of sympathetic blockade are possible using chemical neurolytic or ablative modalities. Lumbar sympathetic neurolysis is generally reserved for those patients with ischemic rest pain in the setting of nonreconstructable arterial occlusive disease, although patients with complex regional pain syndrome, peripheral neuralgia, vasospastic disorders, and various other disease states such as plantar hyperhydrosis may also benefit. A working knowledge of procedural anatomy and physiology, accompanied by appropriate patient selection, serve to maximize procedural success and minimize complications, which although infrequent may cause significant morbidity. A review of technique with a focus on traditional fluoroscopy is described, with attention drawn to intraprocedural and immediate postprocedural findings, as well as discussion of expected outcomes.

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Background

First described in 1899 by Jaboulay, and later reported by Leriche, Royle, and Diez in the early 1900's, lumbar sympathectomy became a mainstay of treatment for arterial occlusive disease and other vasospastic disorders before the development of contemporary arterial reconstructive surgical and more recently endovascular procedures.[1,2] While the procedure was recognized to be relatively temporary in its effects, its use as a palliative procedure enjoyed widespread use before the adoption of more advanced vascular reconstructive techniques. The procedure has again seen greater adoption following the development of minimally invasive chemical neurolytic and ablative modalities, primarily in the setting of nonreconstructable vascular disease. An understanding of procedural anatomy and physiology, as well as an appreciation for patient selection, are paramount if favorable results are to be expected.

Anatomy

The lumbar sympathetic chain lies along the anterolateral margin of the lumbar vertebral spine, typically spanning L1-L4, with the L1 and L2 ganglia commonly fused. The size, number, and precise location of the sympathetic ganglia are known to be variable. The inferior vena cava maintains a close association along the anterior margin of the right lumbar sympathetic chain, and the aorta is similarly positioned slightly anterior and medial to the left lumbar sympathetic chain.[3] The psoas muscle is situated posteriorly.

Physiology

Preganglionic efferent nerve root fibers travel from the anteromedialateral spinal cord into the lumbar sympathetic ganglia. A small percentage of efferent fibers may also bypass the sympathetic ganglia. Chemical neurolysis results in obliterative fibrosis, causing disruption of the

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Figure 1 Classical pink hyperemia observed immediately after successful sympathetic blockade using percutaneous chemical-mediated neurolysis. (Color version of figure is available online.)

sympathetic ganglia and a reduction in vasomotor tone. This vasodilatory effect, as well as increased arteriovenous shunting within the cutaneous vascular bed, manifests as the typical pink, hyperemic appearance of the foot after successful neurolysis (Fig. 1). In patients with severe arterial occlusive disease, this vasodilatory effect may be less pronounced depending on the basal vasomotor tone. Despite an increase in blood flow, shunting across the cutaneous vascular bed effectively bypasses nutritive delivery at the soft tissue capillary level, although this increase in superficial blood flow is occasionally sufficient to effect wound healing in patients with small cutaneous ulcers. In addition to vasomotor effects, alterations in pain transmission pathways either by interruption of afferent fibers or by changes in tissue norepinephrine and catecholamine levels may act to diminish ischemic rest pain in patients with advanced arterial occlusive disease.

Indications

Patients are generally considered for lumbar sympathetic neurolysis in the presence of severe ischemic rest pain and concurrent nonreconstructable peripheral arterial disease. In our institution, this typically follows a multidisciplinary evaluation by vascular surgery and interventional radiology, in which no further surgical or endovascular option is deemed feasible or beneficial based on a combination of patient, anatomic, and technical factors. Frequently, patients are on significant doses of long-acting and short-acting narcotic pain medications, failing medical management, and suffering diminished quality of life based on outpatient or inpatient assessments. Tissue loss may be present, but typically signs of cellulitis or deep soft tissue infection are absent at the time neurolysis is attempted. Wet gangrene is considered a contraindication, as source control with surgical maneuvers such as incision and drainage, debridement, and amputation are frequently necessary to prevent sepsis and associated morbidity.

Various other disorders may be approached with lumbar sympathetic neurolysis, including complex regional pain syndrome (CPRS), peripheral vasospasm, postherpetic neuralgia, or phantom limb pain. It has also been described for treatment of plantar hyperhidrosis, although we have not performed the procedure for this indication in our recent practice.

Choice of Modality

Chemical-mediated neurolysis is most commonly performed using absolute alcohol; however, phenol has been described in prior literature. Thermal denervation strategies using radiofrequency and laser ablation have also been studied. In a series of 17 patients comparing chemical neurolysis (phenol) to denervation (radiofrequency ablation), less postsympathetic neuralgia was observed with RFA, but the treatment effect as measured by temperature measurements and sweat test was retained in only 12% of patients after 8 weeks, vs 89% in those treated with phenol ($P < 0.05$).[4]

Fluoroscopic guidance is most frequently used, given the close association of the lumbar sympathetic chain to bony targets. Alternatively, CT guidance may be used although this offers less real-time monitoring of needle advancement, realizing that this may be partly mitigated by use of CT fluoroscopy.

Technique

The patient is positioned prone with wide sterile preparation of the lumbar spine region. Prophylactic antibiotics

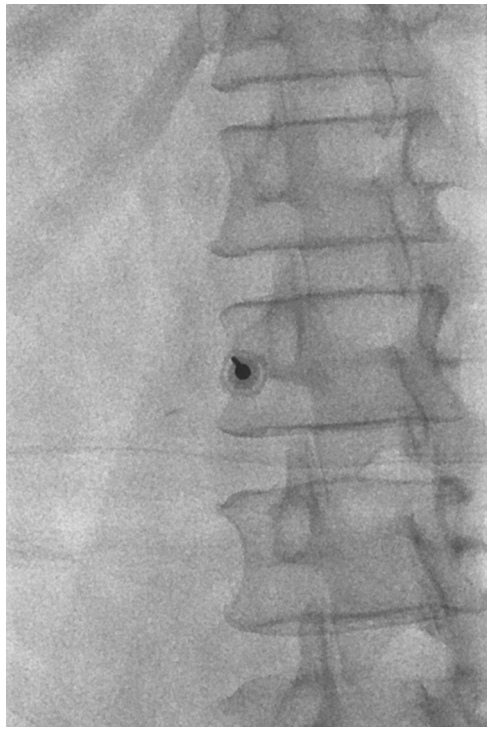

Figure 2 Note oblique orientation of the spine. The needle needs to be guided inferior to the transverse process from this left posterior oblique approach (transverse process faintly overlies current needle trajectory) to reach the perivertebral space.