

## Surgical Lumbal Sympathectomy Procedure as Favorable Treatment Modality for Complex Regional Pain Syndrome (CPRS)

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### Keywords:

Surgical; Lumbal sympathectomy; Neurology; CPRS

## 1. Abstract

**1.1. Background:** Surgical sympathectomy is a surgical procedure to cut and cauterize the sympathetic nerve tissue that runs along the spine, which aims to reduce or eliminate the sympathetic nerve response according to its location. This was first performed in 1923 by Royle and has been a part of the vascular surgery sphere until now. According to the anatomical location, sympathectomy can be performed in the thoracic area or the lumbar area. Lumbar sympathectomy is performed by permanently damaging the sympathetic trunk and ganglion that is attached between L1 and L5, especially between L2 and L4. Pain relief in some cases from complex regional pain syndrome (CRPS) and other vasospastic disorders. Raynaud's phenomenon is characterized by a significant reduction in blood flow throughout the fingers when faced with cold temperatures or stress. As a result, the affected area changes color and can cause the nails to detach. This is caused by hyperactivity to the sympathetic nerves, which triggers extreme vasoconstriction. If left untreated, patients can experience skin and muscle atrophy, even gangrene. Surgical sympathectomy is minimal invasive with better results, and aim of this study to review surgical sympathectomy in Raynaud phenomenon.

**1.2. Discussion:** Lumbar sympathectomy also has the effect of reducing vasomotor tone and blocking afferent pain pathways thereby reducing pain in the patient. As a consequence, postoper-

ative pain control only requires oral analgesics without the need for intravenous analgesics or opioid groups. Significant pain relief was reported in all patients, both with vascular disorders and in complex regional pain syndrome (CRPS), although clinical improvement in patients with complex regional pain syndrome was not apparent.

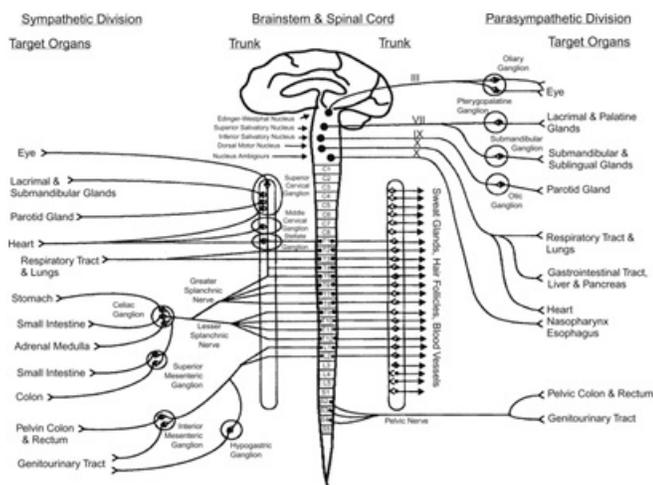
**1.3. Conclusion:** Lumbar sympathectomy is a method used for several indications of disease. The main indications for this procedure are for improvement of lower limb perfusion in occlusive peripheral artery disease (PAPO) and as pain relief in some cases from complex regional pain syndrome (CRPS). Sympathectomy can be performed surgically or chemically with the help of a CT scan by injecting agents such as alcohol or phenol.

## 2. Introduction

The sympathetic nervous system is part of the peripheral autonomic nervous system located in the thoracolumbar part of the spine. This system provides efferent preganglionic innervation of sympathetic neurons in the ganglion which consists of three arrangements, namely, the paravertebral ganglion, prevertebral ganglion, and previsceral ganglion or terminal ganglion. The paravertebral ganglion is a paired structure on the right and left along the vertebral column, which extends from the superior cervical ganglion which lies behind the bifurcation of the internal carotid artery, to

the ganglion located in the sacrum area [1].

The prevertebral ganglion is located in the midline of the body, in front of the aorta and vertebral column. While the prevertebral ganglion or terminal ganglion is a ganglion that is located close to the target organ, it is often referred to as short noradrenergic neurons because their axons have a limited length. The target organs of the sympathetic nerves include smooth muscle and cardiac muscle, glandular structures, as well as parenchyma organs (liver, kidney, bladder, reproductive organs, muscles, etc.) and skin (Figure 1)



**Figure 1.** Schematic overview of the sympathetic and parasympathetic divisions of the peripheral autonomic nervous system [9].

[2].

When the sympathetic nervous system is activated, the body's receptor system responds in the form of pupil dilation, increased minor glandular secretions, bronchodilation, increased heart rate and contraction force, decreased gastrointestinal motility, and decreased function of the reproductive organs. Sympathectomy mainly refers to the destruction of postganglionic noradrenergic nerve fibers and neurons. Sympathectomy consists of various methods, one of which is medication. But, oral medication had many side effects, and another option is surgical sympathectomy [3].

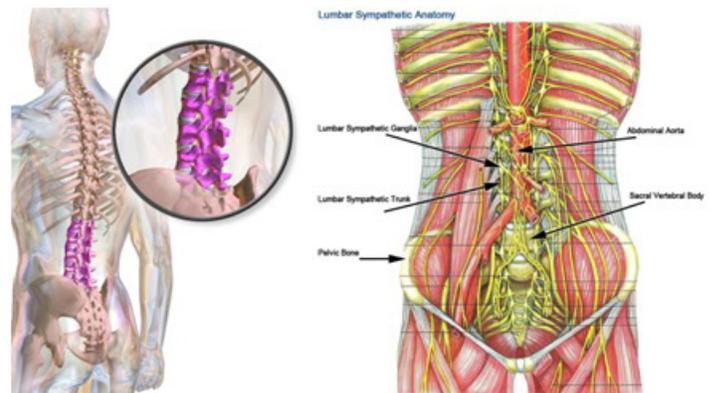
Surgical sympathectomy is a surgical procedure to cut and cauterize the sympathetic nerve tissue that runs along the spine, which aims to reduce or eliminate the sympathetic nerve response according to its location. This was first performed in 1923 by Royle and has been a part of the vascular surgery sphere until now. According to the anatomical location, sympathectomy can be performed in the thoracic area or the lumbar area. Lumbar sympathectomy is performed by permanently damaging the sympathetic trunk and ganglion that is attached between L1 and L5, especially between L2 and L4 [1, 4].

Pain relief in some cases from complex regional pain syndrome (CRPS) and other vasospastic disorders. Raynaud's phenomenon is characterized by a significant reduction in blood flow through-

out the fingers when faced with cold temperatures or stress. As a result, the affected area changes color and can cause the nails to detach. This is caused by hyperactivity to the sympathetic nerves, which triggers extreme vasoconstriction. If left untreated, patients can experience skin and muscle atrophy, even gangrene. Surgical sympathectomy is minimal invasive with better results, and aim of this study to review surgical sympathectomy in Raynaud phenomenon [5].

### 3. Pathophysiology

Irreversible interruption of efferent innervation results in relative vasodilation of small vessels of the lower limb ( $\alpha_1$  receptor blockade), and reduced sweat volume due to inactivation of the eccrine



**Figure 2.** Anatomical Landmark of Sympathetic Lumbar Nerve

glands and lower limb nociception (Figure 2).

#### 3.1. Management of Surgical Sympathectomy

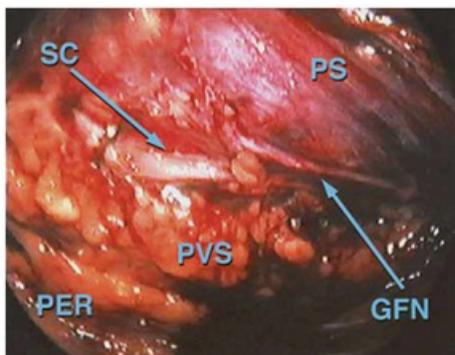
It is often necessary when chemical sympathectomy has been unsuccessful or ineffective in treating the aforementioned disorders. Performing a surgical sympathectomy after chemical sympathectomy is more difficult than if it was done initially. Surgical sympathectomy can now be performed openly (open sympathectomy) or laparoscopically (laparoscopic sympathectomy). Sympathectomy should not be performed in patients with acute phase thromboangitis obliterans with symptoms of spontaneous neuritis and inflammatory pain. Sympathectomy is also not indicated in cases with severe ischemia that can become gangrenous and require amputation, because it cannot improve blood flow, although it can reduce pain [6].

Sympathectomy should also be avoided in patients on anticoagulant therapy and bleeding disorders because there is a significant risk of vascular damage with the use of this technique because the sympathetic trunk is deep and close to the main vessels. A large hematoma can form when there is a clotting disorder. In addition, the presence of local infection or neoplasm is also not indicated because the needle should not be injected through infected tissue or neoplastic tissue because there is a risk of spreading to deeper structures [7, 8].

Lumbar sympathectomy is also not indicated if there are anatomical or vascular abnormalities. Anatomical abnormalities (such as pressure from the tumor or spinal scoliosis) can make the block more difficult and reduce the success rate. Deformed blood vessels increase the risk of needle puncture failure. In hypovolemic conditions, bilateral splanchnic, coeliac and lumbar sympathetic blocks can lead to hypotension. Incomplete facilities such as facilities for resuscitation and radiographic control of the procedures performed must be available for the procedure to run smoothly [9, 10].

Lumbar sympathectomy can be done by these steps as: [11, 12, 13]

1. Management of sympathetic blocks requires a thorough understanding of the relevant anatomy and pathophysiology of the underlying condition. Sympathetic block complications are quite common and can be serious.
2. Informed consent must be given before the block is carried out so that the patient understands what action is planned and for what purpose the block is carried out.
3. Resuscitation kits should be readily available and deployed quickly.
4. Safe venous access is essential for every patient and facilities for treatment in case of hypotension should be available. Pre-load intravenous fluids in the form of crystalloid solutions are usually given for all bilateral blockades (splanchnic, coeliac, lumbar sympathetic superior hypogastricity).
5. Patients may experience discomfort when the block is applied and many physician's sedate drugs such as midazolam and alfentanil in addition to infiltration with local anesthetics. General anesthesia is rarely needed.
6. Close monitoring should include regular measurement of blood pressure and pulse oximetry. Oxygen desaturation may occur with sedation, especially when the patient is in the pronation position.
7. Radiological control in the form of an image intensifier, ultrasound, or CT scan should be performed on splanchnic, coeliac, lumbar sympathetic and hypogastric blocks.



**Figure 3.** Retroperitoneoscopic view of operative field

8. Aseptic technique is important (Figure 3).

#### 4. Discussion

Beglaibter et al conducted a study of 29 patients in which lumbar sympathectomy was performed laparoscopically. Five of the patients had previously undergone chemical sympathectomy. A total of 21 patients underwent one-sided sympathectomy, and the rest from two sides. For one-sided retroperitoneoscopic lumbar sympathectomy a mean duration of 136 minutes (range 60-280 minutes) is required [7, 14].

There are three large studies that have shown a positive effect in 63.6-93.4% of cases of PAPO and in 97-100% of cases of hyperhidrosis. The positive effects that are obtained after the surgical procedure is completed are warmer and drier lower extremities, increased blood flow through the collateral vessels, accelerated healing of chronic defects and loss of sweating [8, 15].

Bozkurt et al. in their randomized controlled trial (RCT) study found that after the end of therapy (4 weeks) total ulcer healing was obtained in 41% (23/57) of patients with Obliterans Thromboangitis / Buerger's Disease who were given surgical sympathectomy intervention, and Subsequent evaluation at 24 weeks after starting therapy found that 52.3% (30/57) of patients experienced complete ulcer healing [9, 16].

Lumbar sympathectomy also has the effect of reducing vasomotor tone and blocking afferent pain pathways thereby reducing pain in the patient. As a consequence, postoperative pain control only requires oral analgesics without the need for intravenous analgesics or opioid groups. Significant pain relief was reported in all patients, both with vascular disorders and in complex regional pain syndrome (CRPS), although clinical improvement in patients with complex regional pain syndrome was not apparent [7, 17, 18].

Bozkurt et al. reported after the end of therapy (4 weeks), total relief of resting pain without analgesic therapy was reported in 43.1% (30/57) of patients with obliterans' thromboangitis after surgical sympathectomy. In several other studies, the incidence of claudication also improved after sympathectomy. The morbidity rate and the number of cases requiring amputation also decreased with this lumbar sympathectomy [9, 18, 19].

#### 5. Conclusion

Lumbar sympathectomy is a method used for several indications of disease. The main indications for this procedure are for improvement of lower limb perfusion in occlusive peripheral artery disease (PAPO) and as pain relief in some cases from complex regional pain syndrome (CRPS). Sympathectomy can be performed surgically or chemically with the help of a CT scan by injecting agents such as alcohol or phenol. This chemical method has been reported to be successful several times, but the long-term results are still inconsistent. In addition, complications from the injection as well as the side effects of the injected chemicals can cause ure-

teral damage. Chemical sympathectomy performed before surgery is associated with a more difficult dissection with more bleeding,

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