

Effectiveness of Computed Tomography-Guided Percutaneous Chemical Lumbar Sympathectomy in Peripheral Arterial Vascular Disease

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Abstract

Introduction: Lumbar sympathectomy was first developed in 1924 by Hunter and Royle. Lumbar sympathectomy has been performed without image guidance by anesthetists and surgeons in earlier days. Now, it is performed under image guidance as it is effective and safe procedure for the relief of pain produced by severe peripheral arterial vascular disease.

Purpose: Purpose of the percutaneous lumbar chemical sympathectomy under computed tomography (CT)-guidance were to achieve the exact location of needle placement and deposition of neurolytic agent 10% phenol in glycerine to relive pain in severe peripheral arterial vascular disease. It is cost effective and widely available treatment option which takes less time to staying in hospital as it is out patients procedure.

Materials and Methods: Institutional approval and informed consent from patients were obtained. The study was conducted from March 2004 to July 2015 on 46 patients of either sex (45 male and 1 female), aged between 30 and 78 years, referred to Department of Radio-diagnosis and Department of Anesthesia and Pain Management, Pt. J. N. M. Medical College, Dr. B. R. A. M. Hospital, Raipur, India. Assessment of pain was done by visual analog scale (VAS). Full aseptic precautions were taken during the procedure. Under the guidance of CT scanner (Siemens, Germany) 20 G, 15 cm long graduated sympathectomy needle was inserted, and needle tip was positioned anterolateral to the L3 vertebral body. 10 ml phenol (10%) mixed with 0.5 ml contrast media was injected after negative aspiration.

Result: Mean baseline value of pain intensity by VAS was 6.22, after 72 h and 1 month it was 2.65 and 1.80, respectively, which were statistically significant. None of the patients had a complication.

Conclusion: CT-guided percutaneous chemical lumbar sympathectomy appears to be safe, effective, and less costly palliative procedure for controlling lower limb pain.

Key words: Chemical sympathectomy, Multidetector computed tomography, Phenol, Percutaneous, Peripheral vascular disease

INTRODUCTION

Periarterial sympathectomy on femoral artery done by Jabouly in 1889 and Leriche in 1921 got disappointing result due to reinnervation and vasospasm within weeks

of operation. Lumbar sympathectomy was first developed in 1924 by Hunter and Royle.¹

Chemical lumbar sympathectomy is accepted, and effective therapeutic option in patients of peripheral arterial vascular diseases in outpatients department basis who are not eligible for surgical intervention and are not suitable candidate for reconstructive surgery because there vascular status not permit for it, and have reduced response of oral medication or uncontrolled pain.²

Several imaging modalities have been used for needle guidance such as fluoroscopy, sonography, and magnetic

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resonance (MR) imaging. These methods are less preferred because inconsistent results. MR imaging is incompatible with needle.³⁻⁵ Hence, we preferred computed tomography (CT)-guided imaging for needle placement were needle tip position precisely at the sympathetic trunk and avoided risk of puncturing the surrounding structure and vessels.

Anatomy

The lumbar sympathetic plexus is contiguous with the thoracic sympathetic chain above and the pelvic chain below. It runs along the medial border of the psoas muscle, entering the abdomen from behind the medial arcuate ligament. The right sympathetic trunk lies behind the lateral border of the inferior vena cava (IVC) and the left sympathetic trunk lies close to the lateral border of the aorta. The trunk includes four segmentally arranged ganglia most often present opposite the mid body of L3 and its upper and lower disk spaces. Branches from the lumbosacral sympathetic trunk included (a) postganglionic fibers that are distributed through branches of the spinal nerves to the blood vessels, sweat gland, and erector pill muscles, (b) branches to the sympathetic plexus of the aorta and its branches, and (c) branches to the inferior continuation of the sympathetic plexus including the superior hypogastric plexus. The sympathetic neural fibers have been implicated in the maintenance of chronic pain in certain neuropathic condition.^{6,7}

MATERIALS AND METHODS

Institutional approval and informed consent from patients were obtained. In our study, we included all the patients with the peripheral arterial vascular disease who were not required surgery or who were in Stage II Intermittent claudication. Stage IIa: Intermittent claudication after more than 200 m of pain free walking, Stage IIb: Intermittent claudication after <200 m of walking, Stage III: Rest pain, and Stage IV: Ischemic ulcers or gangrene according to Fontaine classification and those who were post amputated but having pain. The diagnosis was confirmed clinically, laboratory, as well as radiologically. The study was conducted between March 2004 and July 2015 on 46 patients. Out of these 45 were male and 1 was female. Patients were between 30 and 78 years of aged. Visual analog scale (VAS) was used to access the pain before the procedure and consider as a baseline value. The VAS consist of 10 cm line marked at one end with term “no pain” at one end and at the other end the “worst possible pain.” Patients made a cross on the line at the point that best approximates to their pain intensity as explain during patient evaluation on his own language. It was graded as

0-10 (0 = No pain, 10 = Worst pain, Mild = 1-3, Moderate = 4-6, Severe = 7-10).

Patients were kept nil orally 6 h for solid, semisolid, and milk prior to the procedure. 100-200 ml clear fluid allowed 3 h prior to the procedure. Patients may continue to take their existing medications including analgesics. Multipara monitor was attached, and pulse, NIBP, SPO₂, electrocardiogram were monitored. Intravenous access was done and DNS 100 ml/h started.

The patients were placed on the table in prone position. Premonitored the location of needle placement, depth, and direction identified by CT imaging to avoid the puncture of major vascular and visceral structures. (Figure 1). After full aseptic precautions, needle insertion site was infiltrated with 2% lignocaine with adrenaline. A 20 G, 15.0 cm long, graduated sympathectomy needle was inserted gently through the skin tangent to the right lateral or left lateral depending on the side of pain, at the distance approximately 7-9 cm from the midline under CT-guidance at the level of L3 vertebrae. The needle was directed tangentially to the superior articular process. Placement of the needle anterior to the psoas muscle and posterolateral to the IVC or aorta (Figure 2) and confirm the needle tip position under the guidance of CT scan (we also confirmed by loss of resistant (LOR) technique using LOR syringe while the needle was inserted). In this study, the procedure was done on the right side in 32 patients and left side in 14 patients. Prior to injecting phenol negative aspiration was done to check for blood and cerebrospinal fluid. 0.25 ml of contrast media added in bupivacaine 10 ml (0.25%) and 5 ml injected to see the spread of solution, venodilatation, and for effective pain relief.



Figure 1: Axial multidetector computed tomography image at L3 vertebral body level shows the sympathetic chain as small dot in fatty triangle between the spine, psoas muscle, and aorta on the left side, and between the spine, psoas muscle, and inferior vena cava on the right side

There after 10 ml 10% phenol mixed with 0.50 ml contrast media in glycerine was injected after negative aspiration and confirmed by CT scan (Figure 3). Finally, small volume of normal saline injected before the needle was withdrawn to minimize the spread of phenol.

RESULT

By the Graphpad's analysis software mean baseline value of pain intensity by VAS was 6.22, after 72 h and 1 month of procedure the mean baseline value of pain intensity reduced to 2.65 and 1.80, respectively (Tables 1 and 2). Statistically significant decrease in pain intensity observed from baseline value. None of the patients had aortic, inferior vena caval puncture, pneumothorax, renal puncture, dural puncture, and nerve damage (Table 3).



Figure 2: Axial multidetector computed tomography images shows tip of 20 G needle between the spine, psoas muscle, and inferior vena cava on the right side

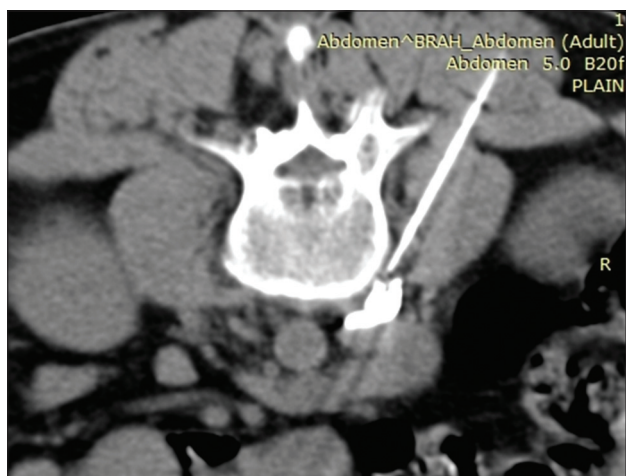


Figure 3: Axial multidetector computed tomography images show spread of phenol mixed contrast material posterolateral to inferior vena cava at the tip of needle on the right side

DISCUSSION

The indication for percutaneous chemical lumbar sympathectomy is pain from lower limb ischemic disease including Raynaud's disease, sympathetic dystrophy, pelvic and perineal pain of malignant or nonmalignant origin. In our study, we included peripheral arterial disease (PAD) of the lower limb and one female patient of Raynaud's disease. The single needle was used at the level of L3 vertebrae. 10% phenol in glycerine was chosen as an agent for therapeutic chemical sympathectomy and 10 ml volume mixed with 0.25 ml of contrast was administered. Viscous nature of glycerine limits the spread. Before injecting, we warm the agent.

According to International Association for Study of Pain define as "an unpleasant sensory and emotional experience associated with actual and potential tissue damage, or described in terms of such damage." "Pain is always subjective."⁸

It is of either acute or chronic in type. PAD pain is chronic in type. It is most commonly occur in low socioeconomic status people, and the most common risk factor is bidi or cigarette smoking. Other risk factors include diabetes, high blood pressure, and high blood cholesterol. In PAD, there is fatty deposition in the arteries which causes restricted blood supply to the leg muscles. Many patients are asymptomatic, but some feel painful aching in there leg muscles that are aggravated by physical activity like walking or climbing stairs. This type of pain known as intermittent claudication. The pain can range from mild to severe. Pain also occurs at resting condition. Some relief of symptoms is possible with exercise, pharmacotherapy, and cessation of smoking. Primarily it treated by managing lipids, blood sugar, and blood pressure. If the treatment is not effective and the symptoms of PAD often develop slowly over time but if symptoms get suddenly worse it could be a serious problem and requiring immediate treatment. Revascularization is required to restore the flow of blood. These types of patients are considered for surgery,

Table 1: Patients characteristic profile and outcome

Number of case	Indication	Pain duration prior to procedure (months)	Effective pain relief after 72 h	Effective pain relief after 1 month
2	PAVD	8	Improved	Improved
7	PAVD	10	Improved	Improved
15	PAVD	12	Improved	Improved
10	PAVD	18	Improved	Improved
7	PAVD	24	Improved	Improved
4	PAVD	30	Improved	Improved
1	Raynaud's disease	32	Improved	Improved

PAVD: Peripheral arterial vascular disease

Table 2: VAS score

VAS score	Baseline VAS score		After 72 h			After 1 month		
	Number of patients	Mean±SD	Number of patients	Mean±SD	P value	Number of patients	Mean±SD	P value
1-3	0		34			41		
4-6	34	6.2±1.69	12	2.65±1.70	<0.0001	5	1.8±1.17	<0.0001
7-10	12		0			0		

VAS: Visual analog scale, SD: Standard deviation

Table 3: Complication

IVC/aortic puncture	Nil
Visceral structure (kidney/lungs) injury	Nil
Nerve injury	Nil
Dural puncture/CSF aspiration	Nil

IVC: Inferior vena cava, CSF: Cerebrospinal fluid

and we excluded them from our study. We included the patients according to fontaine classification⁹ Stages II-IV and previously amputated patients having pain. The pain was graded by VAS.

Lumbar sympathectomy indicated for peripheral arterial vascular disease; It can be used as temporarily or irreversibly block. It can be performed by open surgery. It can be performed as a blind procedure. Other imaging modalities are fluoroscopically¹⁰ and sonographically⁴ guided lumbar sympathetic blocks have been performed with varying success rate. These methods are less likely than CT-guided lumbar sympathetic block to result in the needle tip being positioned precisely at the sympathetic trunk.

In our study, the procedure was more beneficial for pre-gangrenous patients Stages II-III and the patients who were even unable to sleep. The patients who were already developed gangrene or Stage IV had less beneficial effect although they were also improved, but all the patients had not developed any complication during or after the procedure. On follow-up after 1 month, they were feel comfortable during walking, and even they increases there walking distance from previous, had no rest pain and improved lifestyle.

Lumbar sympathectomy causes increased distal perfusion by elimination the vasoconstriction caused by sympathetic nerve and reduces the sympathetic pain.

Before CT-guidance, pain management physicians used either an unguided method or fluoroscopic guidance to provide general localization of the needle. In the blind procedure of lumbar sympathectomy, there is a risk to puncture of major vascular structures such as the aorta, IVC, and injury to nerve.

At our institution, CT-guidance is preferred for needle insertion. It is more precise because needle tip is targeted at the expected location of sympathetic trunk which is located within fat tissue between the lumbar spine, psoas muscle¹¹ and aorta or IVC.¹² The advantage of CT over blind procedure or other imaging modality like fluoroscopic techniques is that to exact position of needle, distribution of anesthetic medicine or solution, and major vascular structures such as aorta, IVC, surrounding visceral structures such as kidney, lungs can be avoided from puncture. The level of insertion was L3 decreases the risk of pneumothorax; there is a risk of puncture to the renal pelvis, epidural injection, disk perforation, L1 nerve damage and lymphocele formation. So that without any risk patients get relieved from their pain.

According to the literature, Pieri *et al.*,¹³ done percutaneous sympathectomy under CT-guidance by using phenol at the level of L2 and L4 by using two 22 G needles (15 cm long) in 19 patients who had severe vascular disease of the lower extremities with rest pain and gangrene and they were not eligible for surgical revascularization. They found out of the 19 patients, 9 (47.3%) showed clinical improvement, whereas 5 experienced a worsening of ischemia in the months immediately following the procedure.

Schmid *et al.*,¹⁴ evaluate the accuracy of sympathetic skin response (SSR) for monitoring CT-guided lumbar sympathetic blocks, 70 individual lumbar sympathetic blocks were performed in 13 patients with reflex sympathetic dystrophy of the foot. They use a 22 G needle at midlumbar level advanced to sympathetic trunk with CT fluoroscopic guidance; they use 1 ml of iopamidol (200 mg of iodine per ml) and 5 ml of 0.5% bupivacaine. SSR ratio (SSR in the injected foot versus SSR in the contralateral foot) was calculated before injection and repeatedly at 1 min intervals thereafter. They found 30 min after injection, 83% of procedures were considered clinically successful. Sensitivity, specificity, and accuracy of SSR for prediction of clinical success were 84%, 92%, and 86%, respectively, 4 min after injection and 95%, 92%, and 94%, respectively, 7 min after injection.

Tay *et al.*,¹⁵ done chemical lumbar sympathectomy under the guidance of CT-fluoroscopy inoperable peripheral vascular

disease they found improvement in 30.3% cases, 45.4% cases had no change and 24.3% cases get deteriorated. Within 3 months, complication rate was <1% and efficacy were of 30%.

Koizuka *et al.*,¹⁶ done fluoroscopic CT-guided percutaneous lumbar sympathectomy for a safest route for needle insertion in 25 patients. They found the distance from the midline (spinous process) to the entry point and the depth to the target site correlated with body size and the maximal distance from midline to the insertion point in the range of safe needle insertion at L2 was <7 cm in approximately 20% patients.

CONCLUSION

CT-guided percutaneous chemical lumbar sympathectomy appears to be safe, effective, and less costly palliative procedure for controlling lower limb pain in inoperable peripheral arterial vascular diseases.

REFERENCES

1. Royle JP. A history of sympathectomy. *Aust N Z J Surg* 1999;69:302-7.
2. Heindel W, Ernst S, Manshausen G, Gawenda M, Siemens P, Krahe T, *et al.* CT-guided lumbar sympathectomy: Results and analysis of factors influencing the outcome. *Cardiovasc Intervent Radiol* 1998;21:319-23.
3. Rosen RJ, Miller DL, Imparato AM, Riles TS. Percutaneous phenol sympathectomy in advanced vascular disease. *AJR Am J Roentgenol* 1983;141:597-600.
4. Kirvelä O, Svedström E, Lundbom N. Ultrasonic guidance of lumbar sympathetic and celiac plexus block: A new technique. *Reg Anesth* 1992;17:43-6.
5. Sze DY, Mackey SC. MR guidance of sympathetic nerve blockade: Measurement of vasomotor response initial experience in seven patients. *Radiology* 2002;223:574-80.
6. Snell RS. *Clinical Anatomy for Medical Students*. 3rd ed. Boston: Little, Brown; 1986. p. 263-4.
7. Rocco AG, Palombi D, Raeke D. Anatomy of the lumbar sympathetic chain. *Reg Anesth* 1995;20:13-9.
8. Merskey H, Bogduk N. *Classification of Chronic Pain: Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms*. Task Force on Taxonomy of the International Association for the Study of Pain. 2nd ed. Seattle, WA: IASP Press; 1994. p. 39-43.
9. Fontaine R, Kim M, Kieny R. Surgical treatment of peripheral circulation disorders. *Helv Chir Acta (in German)* 1954;21:499-533.
10. Umeda S, Arai T, Hatano Y, Mori K, Hoshino K. Cadaver anatomic analysis of the best site for chemical lumbar sympathectomy. *Anesth Analg* 1987;66:643-6.
11. Feigl GC, Kastner M, Ulz H, Breschan C, Pixner T, Dreu M, *et al.* The lumbar sympathetic trunk: Its visibility and distance to two anatomical landmarks. *Surg Radiol Anat* 2013;35:99-106.
12. Hong JH, Kim AR, Lee MY, Kim YC, Oh MJ. A prospective evaluation of psoas muscle and intravascular injection in lumbar sympathetic ganglion block. *Anesth Analg* 2010;111:802-7.
13. Pieri S, Agresti P, Ialongo P, Fedeli S, Di Cesare F, Ricci G. Lumbar sympathectomy under CT guidance: Therapeutic option in critical limb ischaemia. *Radiol Med* 2005;109:430-7.
14. Schmid MR, Kissling RO, Curt A, Jaschko G, Hodler J. Sympathetic skin response: Monitoring of CT-guided lumbar sympathetic blocks. *Radiology* 2006;241:595-602.
15. Tay VK, Fitridge R, Tie ML. Computed tomography fluoroscopy-guided chemical lumbar sympathectomy: Simple, safe and effective. *Australas Radiol* 2002;46:163-6.
16. Koizuka S, Saito S, Obata H, Tobe M, Koyama Y, Takahashi A. Anatomic analysis of computed tomography images obtained during fluoroscopic computed tomography-guided percutaneous lumbar sympathectomy. *J Anesth* 2008;22:373-7.

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