



PERCUTANEOUS CHEMICAL LUMBAR SYMPATHECTOMY – ROLE IN UNRECONSTRUCTABLE OR NON-GRAFTABLE PERIPHERAL VASCULAR DISEASE

Surgery

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ABSTRACT

Objectives: The objective of this study was to evaluate the efficacy, safety, and clinical outcome of percutaneous chemical lumbar sympathectomy (PCLS) in unreconstructable or non-graftable peripheral vascular disease. **Method:** PVD patients who underwent PCLS in Vascular surgery department of a teaching hospital (Government Medical College and Hospital) in Maharashtra, India. Study was carried out from March 2017 to November 2019. Diagnosis of PVD was made on clinical grounds and color Doppler study. Arterial patency was seen by CT angiography. All these patients were unreconstructable or non-graftable. PCLS was done under image. After PCLS, patients were followed up on next day and after 4 and 12 weeks. Outcome monitored were improvement in rest pain (using visual analog scale) and healing of ischemic ulcers. **Results:** All patients were males, chronic bidi smokers, most patients were in the range 45–75 years of age. All had involvement of lower limbs either ischemic rest pain or ischemic ulcers. A total of 17 PCLS (15 unilateral and 2 bilateral) were performed on 17 PVD. Imaging modality was C-arm fluoroscopy. Did their Follow-up on next day, after 4 weeks and 12 weeks. Outcome parameters monitored were improvement in rest pain by 1–10 visual analog score (VAS, 1–6 = Satisfactory, 7–10 = unsatisfactory) and healing of ischemic ulcer. Excellent rest pain relief was obtained, which lasted for 3 months of follow-up in 75% patients, while ulcer healing was seen in 71% of patients. Those patients who were not benefited were having long segment or very high disease. **Conclusions:** PCLS can provide safe and efficient treatment for rest pain and healing of ischemic ulcers in PVD.

KEYWORDS

percutaneous chemical lumbar sympathectomy, unreconstructable, non-graftable, peripheral vascular disease.

INTRODUCTION

Peripheral vascular disease (PVD) of lower limbs is the most common pathology seen in vascular surgical practice. The management of patients with unreconstructable or non-graftable (due to lack of reformation in distal Popliteal or proximal Anterior Tibial Artery or Posterior Tibial Artery) distal disease with rest pain has always been difficult (1,2) with the obvious endpoint being limb amputation. Attempts to improve the quality of life by alleviating rest pain without limb ablation have led to the development of lumbar sympathectomy. Percutaneous Lumbar chemical sympathectomy (PCLS) is used primarily in the treatment of ischemic rest pain with unreconstructable distal vessels and in the management of arterial ulcers. Symptomatic improvements following LCS in patients with critical leg ischemia have been demonstrated in cohort studies and randomised controlled trials, but most have failed to identify objective benefits (3,4,5,6). The objective of this study was to evaluate the efficacy, safety, and results of PCLS in unreconstructable or non-graftable PVD.

TECHNIQUE:

After proper relevant investigations and informed consent, PCLS was performed in prone position. Upper border of L2 (second lumbar) vertebra was palpated; confirmed by imaging (fluoroscopic screening by C-arm), and marked. 5 ml of 2% lignocaine hydrochloride was instilled in a track from about 8 to 12 cms lateral (on the affected side) up to the vertebral body at the level of L2 vertebra. A 20-gauge spinal needle with stylet was inserted (under fluoroscopic screening using C-arm) at the angle of approximately 70° from the surface and was directed forward and medially, parallel to and maintaining relation with L2 vertebra so as to touch the tip of its transverse process [Figure 1]. Then, the needle was guided forward and medially 2–3 cm maintaining the same angle till the bony resistance was felt against the L2 vertebral body. Second film was taken at this time to confirm final position of needle at the anterolateral aspect of L2 vertebral body. Next, 1.5 ml of water-soluble nonionic contrast Iohexol 3% dye was injected, and third exposure for C-arm was taken at this time to confirm the anterolateral part of vertebra and typical pattern of spread [Figure 2]. The final step was to inject 10 ml of Inj. Phenol in a single rapid shot, which led to patient experiencing a sharp shooting pain and giddiness. In addition, when indicated, contralateral PCLS was also done at the same sitting.

In the immediate post procedure period, pulse and blood pressure were monitored. Patient was kept under observation for 24 hours and

discharged next day. Follow-up was done after 4 and 12 weeks. Outcome parameters monitored were improvement in rest pain by 1–10 visual analog score (VAS, 1–6 = Satisfactory, 7–10 = unsatisfactory) and healing of ischemic ulcer.

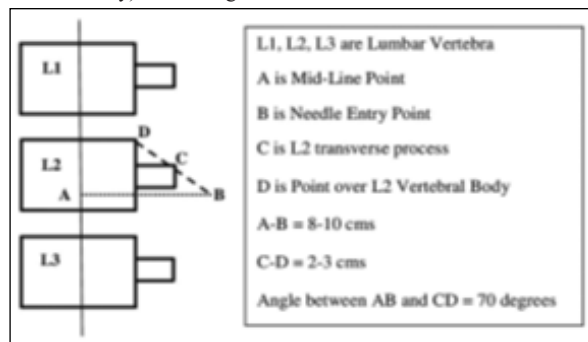


Figure 1: Diagrammatic representation of technique of percutaneous chemical lumbar sympathectomy



Fig. 2: Fluoroscopic image showing correct needle position and contrast spread.

RESULTS:

A total of 17 PCLS procedures were performed on PVD patients in

Vascular Surgery department of a teaching hospital (Government Medical College and Hospital) in Maharashtra, India and study was carried out from March 2017 to November 2019.

All patients were chronic smokers, males; most patients were in the range 45–75 years of age. All patients had involvement of lower limbs either ischemic rest pain or ischemic ulcers or gangrene of toes. Ankle pressure index could not be measured in large number of patients as their dorsalis pedis and posterior tibial arteries were not palpable. Arterial patency was seen by CT angiography. All these patients were unreconstructable or non-graftable (due to lack of reformation in Distal Popliteal or proximal Anterior Tibial Artery or Posterior Tibial Artery). All patients We performed PCLS in total 17 patients (15 unilateral and 2 bilateral). Success rate for PCLS was 76.47% across the patients [Table A].

Excellent rest pain relief was obtained, which lasted for 3 months of follow-up in 75% patients, while ulcer healing was seen in 71% of patients [Table A]. Those patients who were not benefited were having long segment or very high disease (One patient had Aortic disease and two patients had Aorto-Iliac disease). The patients who had Aortic disease (one patient) and Aorto-Iliac disease (one patient) needed AK amputation at later date within 12 weeks of PCLS.

No. of patients (total 17)	VAS score		Ulcer healing (total no of patients with ulcer - 7)		Complications (long term)
	1-6	7-10	Yes	No	
Next day	14	3	-	-	1
4 weeks	13	4	5	2	1
12 weeks	13	4	5	2	1

Transient paresthesia (lasting a week's time), over the lateral side of thigh, was the only complication seen in a small number of patients. Only 1 limb (5.88%) had persistent paresthesia which lasted for more than 12 weeks [Table A]. None of the patients with bilateral sympathectomies complained of sexual dysfunction.

DISCUSSION:

The concept of sympathetic denervation as mode of therapy for arterial occlusive disease was first described by Jaboulay in 1889; however, operative section of lumbar sympathetic chain, in the form of LS, was introduced in the 1920s (7,8). "Chemical sympathectomy" was demonstrated around the same time when phenol and alcohol were applied therapeutically on various arteries and nerves (9). Like most surgical procedures, less invasive version of LS appeared in the form of PCLS in 1949 and has gained popularity since the 1970s due to availability of CT and C-arm imaging techniques (10,11). Of late, increasing acceptance of nerve blocks for pain has led to a renewed interest in this procedure.

Although no guidelines currently exist for the use of PCLS in PVD, many vascular surgeons continue to use it. With regard to indications, rest pain with unreconstructable distal arterial disease is the main indication. Ulcers and trash feet were the other common indications. Other uncommon indications included Raynaud's disease, Buerger's disease and complex regional pain syndrome (12). Complications of PCLS included transient or persistent paresthesia of limb, genitofemoral and femoral nerve neuralgia, retroperitoneal haematoma, ureteric damage and paraplegia secondary to inadvertent extradural injection.

Lumbar sympathectomy acts as vasodilator by decreasing sympathetic tone, so improving tissue oxygenation. This principle underlies its use in ulcer healing. It also decreases pain by interrupting sympathetic-nociceptive coupling and by a direct neurolytic action on nociceptive fibres. Lumbar sympathectomy can be performed using both open surgical and laparoscopic techniques (13,14,15), and non-invasively through chemical injections, with both techniques offering similar outcomes (16). Although surgical sympathectomy is still being carried out, LCS has largely replaced it.

Role of sympathectomy in treatment of PVDs has been debated right from its inception. Even though there are no clear guidelines two independent surveys have shown that majority of Surgeons are involved in care of PVD patients utilize PCLS to alleviate symptoms of rest pain and as an adjunct to other treatments for ulcers (17,18). Similarly, a "best evidence topic in vascular surgery" summarized that subjective improvements in symptoms for patients with highly

symptomatic critical leg ischemia have been consistently demonstrated in multiple cohort studies (19). High-quality RCTs assessing efficacy of different methods of LS (by open, laparoscopic, and percutaneous methods) are lacking (20); however, over the years, many comparative studies and systemic reviews have shown that results of chemical sympathectomy are "at par" with surgical sympathectomy (21-27).

Rate of successful neurolysis in PCLS, as measured with increased warmth of the affected limb, was consistently over 75%, spread over 3 years of this study [Table A]. We chose L2 as the most suitable point for placement of the tip of the needle due to the anatomical location of the second and third sympathetic ganglions (28,29,30).

A literature review reveals a strikingly wide variation in most of the parameters about PCLS – right from its execution by anesthetists/radiologists/surgeons, technical aspects such as different sites L2/L3/L4, use of single needle/double needle, selection of patients, measurement of outcome/results, and length of follow-up. This discrepancy makes interpreting the results difficult; immediate increase in peripheral circulation after the intervention was shown in 72%–96% patients, pain relief was found in 76%–83.5% patients, 60%–72% had ulcer healing, and long-term relief was found in 30%–88% of patients in different studies (31-43).

Our results with rest pain relief and ischemic ulcer healing compare favorably with these results [Table A]. Sympathectomy works for rest pain and healing of ischemic ulcers because marked reduction in peripheral resistance leads to opening of arteriovenous anastomoses (both dependent on sympathetic vasoactivity thereby increasing blood flow in skin (44). Alleviation of rest pain also occurs because of the neurolysis of afferent pain fibers traveling in the sympathetic chain (45). Effect of sympathectomy on rest pain has been studied in only one randomized, controlled, prospective double-blind trial of phenol chemical sympathectomy against placebo bupivacaine injection. This study done in 41 limbs (24 treatments and 17 controls) showed that rest pain was relieved in 83.5% of patients at 1 week with a placebo response of 23.5% ($P < 0.002$). In addition, 66% of patients remained free from rest pain at 6 months (35).

We had all patients presented with rest pain, or ischemic ulcers or gangrene.

During PCLS, complications may occur due to inadvertent damage to surrounding structures by neurolytic agent. Only one complication—paresthesia over lateral surface of thigh – was seen in the present study. It was noted in 15% - 20% cases across this study and was mostly transient [Table A]. This compares favorably with other studies, which have documented infrequent self-limiting complications such as dysesthesia over L3 dermatomes in thigh, erectile dysfunction, compensatory hyperhidrosis, and retroperitoneal hematoma/abscess (31, 36, 39, 40, 43, 46). Catastrophic complications such as paraplegia following inadvertent extradural injection and ureteric necrosis are, fortunately, extremely rare in literature (18, 47, 48, 49).

CONCLUSIONS:

PCLS can provide safe and efficient treatment for PVD patients with rest pain and healing of ischemic ulcers who have unreconstructable or non-graftable PVD (due to lack of reformation in Popliteal or proximal Anterior Tibial Artery or Posterior Tibial Artery).

REFERENCES:

1. Holdsworth RJ, McCollum PT. Results and resource implications of treating end stage limb ischemia. *Eur J Vasc Endovasc Surg* 1997;13:164–73.
2. Dawson DL, Hagino RT. Critical limb ischemia. Current Treatment Options. *Cardiovasc Med* 2001;3:237–49.
3. Fyfe T, Quin RO. Phenol sympathectomy in the treatment of intermittent claudication: a controlled clinical trial. *Br J Surg* 1975;62:68–71.
4. Cross FW, Cotton LT. Chemical lumbar sympathectomy for ischemic rest pain: a randomised, prospective controlled clinical trial. *Am J Surg* 1985;150:341–5.
5. Holiday FA, Barendregt WB, Slappendel R, Crul BJ, Buskens FG, Van der Vliet JA. Lumbar sympathectomy in critical limb ischemia: surgical, chemical or not at all? *Cardiovasc Surg* 1999;7:200–2.
6. Verma YS, Thakur JR, Sodhi SS. Evaluation of chemical lumbar sympathectomy for chronic arterial ischemia of lower limb(s). *J Anaesthesiol Clin Pharmacol* 2007;23:391–4.
7. Ewing M. The history of lumbar sympathectomy. *Surgery* 1971;70:790–6.
8. Fontaine R. History of lumbar sympathectomy from its origin to the present. *Acta Chir Belg* 1977;76:3–16.
9. Huang J. Letter to the editor. The history of chemical lumbar sympathectomy. *Internet J Anaesthesiol* 2003;7:1.
10. Haxton HA. Chemical sympathectomy. *Br Med J* 1949;1:1026–8.
11. Reid W, Watt JK, Gray TG. Phenol injection of the sympathetic chain. *Br J Surg* 1970;57:45–50.

12. Jeffrey W. Olin, DO, and Brett A. Sealove, MD. Peripheral Artery Disease: Current Insight Into the Disease and Its Diagnosis and Management, Mayo Clin Proc. July 2010;85(7):678-692.
13. Watarida S, Shiraishi S, Fujimura M, Hirano M, Nishi T, Imura M, et al. Laparoscopic lumbar sympathectomy for lower-limb disease. Surg Endosc 2002;16:500-3.
14. Segers B, Himpens J, Barroy JP. Retroperitoneal laparoscopic bilateral lumbar sympathectomy. Acta Chir Belg 2007;107:341-2.
15. Baker DM, Lamerton AL. Operative lumbar sympathectomy for severe lower limb ischemia: still a valuable treatment option. Ann R Coll Surg Engl 1994;76:50-3.
16. Piatko VE, Sukhotin SK. Chemical lumbar sympathectomy in patients with chronic ischemia of the lower extremities. Anesteziol Reanimatol 2004;4:31-3.
17. Seow CS, Doughty JC, Byrne DS. Chemical lumbar sympathectomy revisited: Survey of the current practice of vascular surgeons in Scotland. Eur J Surg 2000;166:380-2.
18. Nesargikar PN, Ajit MK, Evers PS, Nichols BJ, Chester JF. Lumbar chemical sympathectomy in peripheral vascular disease: Does it still have a role? Int J Surg 2009;7:145-9.
19. Sanni A, Hamid A, Dunning J. Is sympathectomy of benefit in critical leg ischaemia not amenable to revascularisation? Interact Cardiovasc Thorac Surg 2005;4:478-83.
20. Karanth VK, Karanth TK, Karanth L. Lumbar sympathectomy techniques for critical lower limb ischaemia due to non-reconstructable peripheral arterial disease. Cochrane Database Syst Rev 2016;12:CD011519.
21. Walsh JA, Glynn CJ, Cousins MJ, Basedow RW. Blood flow, sympathetic activity and pain relief following lumbar sympathetic blockade or surgical sympathectomy. Anaesth Intensive Care 1985;13:18-24.
22. Vulpio C, Borzone A, Iannace C, Agnes S, Mascaro A, De Santis M, et al. Lumbar chemical sympathectomy in end stage of arterial disease: Early and late results. Angiology 1989;40:948-52.
23. Dreyfus A, Fondras JC, Loubrieu G, Ntarundenga U. Our experience of lumbar chemical sympathectomy in arterial occlusive diseases of the lower limbs. Aggressologie 1990;31:207-9.
24. Fraunhofer S, Henzler M, Strotzer M, von Somogy S. Measuring regional blood flow in evaluating CT-controlled lumbar sympathetic neurolysis in arterial occlusive disease. Vasa Suppl 1991;33:160-1.
25. Holiday FA, Barendregt WB, Slappendel R, Crul BJ, Buskens FG, van der Vliet JA, et al. Lumbar sympathectomy in critical limb ischaemia: Surgical, chemical or not at all? Cardiovasc Surg 1999;7:200-2.
26. Piatko VE, Sukhotin SK. Chemical lumbar sympathectomy in patients with chronic ischemia of the lower extremities. Anesteziol Reanimatol 2004;4:31-3.
27. Ruiz-Aragón J, Márquez Calderón S. Effectiveness of lumbar sympathectomy in the treatment of occlusive peripheral vascular disease in lower limbs: Systematic review. Med Clin (Barc) 2010;134:477-82.
28. Yeager GH, Cowley RA. Anatomical observations on the lumbar sympathetics with evaluation of sympathectomies in organic peripheral vascular disease. Ann Surg 1948;127:953-67.
29. Lowenberg RI, Morton DE. The anatomic and surgical significance of the lumbar sympathetic nervous system. Ann Surg 1951;133:525-32.
30. 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.
31. Alexander JP. Chemical lumbar sympathectomy in patients with severe lower limb ischaemia. Ulster Med J 1994;63:137-43.
32. Hughes-Davies DI, Redman LR. Chemical lumbar sympathectomy. Anaesthesia 1976;31:1068-75.
33. Ramos M, Almazán A, Lozano F, Gómez-Alonso A. Phenol lumbar sympathectomy in severe arterial disease of the lower limbs: A hemodynamic study. Int Surg 1983;68:127-30.
34. Hatangdi VS, Boas RA. Lumbar sympathectomy: A single needle technique. Br J Anaesth 1985;57:285-9.
35. Cross FW, Cotton LT. Chemical lumbar sympathectomy for ischemic rest pain. A randomized, prospective controlled clinical trial. Am J Surg 1985;150:341-5.
36. Weyland A, Weyland W, Lamersdorf A, Ensink FB, Hildebrandt J, Kettler D, et al. Neurolytic block of the lumbar sympathetic trunk in advanced stages of peripheral arterial occlusive disease. Anesthesiol Intensivmed Notfallmed Schmerzther 1993;28:420-6.
37. Duda SH, Huppert PE, Heinzelmann B, Schareck W, Seboldt H, Claussen CD, et al. CT-guided percutaneous lumbar sympathicolysis in peripheral arterial occlusive diseases. Rofo 1994;160:132-6.
38. Mashiah A, Soroker D, Pasik S, Mashiah T. Phenol lumbar sympathetic block in diabetic lower limb ischemia. J Cardiovasc Risk 1995;2:467-9.
39. Gleim M, Maier C, Melchert U. Lumbar neurolytic sympathetic blockades provide immediate and long-lasting improvement of painless walking distance and muscle metabolism in patients with severe peripheral vascular disease. J Pain Symptom Manage 1995;10:98-104.
40. Tay VK, Fitridge R, Tie ML. Computed tomography fluoroscopy-guided chemical lumbar sympathectomy: Simple, safe and effective. Australas Radiol 2002;46:163-6.
41. Huttner S, Huttner M, Neher M, Antes G. CT-guided sympathicolysis in peripheral artery disease-Indications, patient selection and long-term results. Rofo 2002;174:480-4.
42. Bhattarai BK, Rahman TR, Biswas BK, Sah BP, Agarwal B. Fluoroscopy guided chemical lumbar sympathectomy for lower limb ischaemic ulcers. JNMA J Nepal Med Assoc 2006;45:295-9.
43. Nickel J, Brinckmann W, Andresen R. Ambulatory, CT-assisted lumbar sympathicolysis in patients with severe peripheral artery disease: Influence on peripheral blood flow and clinical outcome. Zentralbl Chir 2008;133:349-54.
44. Agarwal P, Sharma D. Sympathectomy revisited: Current status in management of critical limb ischemia. In: Dieter RS, Dieter RA Jr., Dieter RA 3rd, Nanjundappa A, editors. Critical Limb Ischemia: Acute and Chronic. Switzerland: Springer International Publishing; 2016. p. 459-64.
45. Coventry BJ, Walsh JA. Cutaneous innervation in man before and after lumbar sympathectomy: Evidence for interruption of both sensory and vasomotor nerve fibres. ANZ J Surg 2003;73:14-8.
46. Pennekamp W, Krumova EK, Feigl GP, Frombach E, Nicolas V, Schwarzer A, et al. Permanent lesion of the lateral femoral cutaneous nerve after low-volume ethanol 96% application on the lumbar sympathetic chain. Pain Physician 2013;16:391-7.
47. Antao B, Rowlands TE, Singh NP, McCleary AJ. Pelviureteric junction disruption as a complication of chemical lumbar sympathectomy. Cardiovasc Surg 2003;11:42-4.
48. Wijeyaratne SM, Seneviratne LN, Umashankar K, Perera ND. Minimal access is not maximal safety: Pelviureteric necrosis following percutaneous chemical lumbar sympathectomy. BMJ Case Rep 2010;2010. pii: Bcr1220092538.
49. Ranjan P, Kumar J, Chipde SS. Acute renal failure due to bilateral ureteric necrosis following percutaneous chemical lumbar sympathectomy. Indian J Nephrol 2012;22:292-4.