Research Article

Technique of computed tomography guided chemical lumbar sympathectomy for peripheral vascular disease-a study of its efficacy in the Indian population

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ABSTRACT

Background: Surgical lumbar sympathectomy is an established procedure in the treatment of peripheral vascular disease for patients with severe rest pain and where revascularization is not possible. The aim of the present study is to evaluate the efficacy of chemical lumbar sympathectomy using computed tomography (CT) guidance in the Indian population.

Methods: A prospective study was done on 22 patients with inoperable peripheral vascular disease in Coimbatore medical college hospital, Coimbatore between June 2013 and May 2015. Using Toshiba 4-slice helical CT guidance and absolute alcohol as neurolytic solution, chemical lumbar sympathectomy was performed at single level. Rest pain was assessed by visual analogue scale. Size of the ischemic ulcers were measured before and 2 months after the procedure.

Results: At 2 months post procedure, 77 % of patients reported substantial relief of rest pain. In 57% of patients, there was significant reduction in size of the ulcers.

Conclusions: Lumbar sympathectomy has still got a specific role in modern vascular surgery practice. The precision of computed tomography guidance in chemical neurolysis is unparalleled. It is safe, as effective as surgical sympathectomy and can be quickly performed as an out-patient procedure with local anaesthesia. It is a valuable technique that can be easily mastered by the radiologist doing interventional procedures using computed tomography.

Keywords: Chemical lumbar sympathectomy, CT, Neurolysis, Rest pain

INTRODUCTION

Lumbar sympathectomy is an established procedure in the treatment of peripheral vascular disease, especially thrombo angitis obliterans. It is currently an option for patients with severe rest pain, early ischemic ulcers and where revascularization is not feasible. Surgical lumbar sympathectomy has the morbidity and risks associated with any surgical procedure. Chemical neurolysis of lumbar sympathetic chain can be accurately performed using computed tomography (CT) guidance. The aim of the study is to evaluate the efficacy of CT guided chemical lumbar sympathectomy (CTLS) in the treatment of inoperable peripheral vascular disease.^{1,2}

METHODS

The study is a prospective study done on 22 patients in Coimbatore medical college hospital between the periods June 2013 to May 2015. Patients were selected if they satisfied the following inclusion criteria (i) Rest pain, (ii) Ankle-brachial pressure index >0.3, (iii) Poor feasibility of revascularizations as certified by vascular surgeon and (iv) Limited ulceration/single toe gangrene. Toshiba 4-slice helical CT scan machine was used for all the procedures. The neurolytic solution used was absolute alcohol. The first and second authors performed the procedures. Rest pain was assessed using Visual analogue scale (VAS). The size of all the ulcers were measured and documented before the procedure.³

Technical description of procedure

Positioning of patient

The patient is positioned prone in the computed tomography couch. 5 mm thick axial scans through L2, L3 and L4 vertebrae were taken in helical mode.

Confirmation of side and identification of lumbar sympathetic trunk/ureter

The side where the procedure needs to be done is confirmed from the patient as well as the case records. The lumbar sympathetic trunk is not directly identified in CT. The location is gauged by the anatomical landmarks. Abdominal aorta and IVC are identified by their shape and usual anatomical location.

The left lumbar sympathetic trunk is located just posterolateral to abdominal aorta and right lumbar sympathetic trunk is located just postero-lateral to IVC, in close proximity to anterior aspect of lumbar vertebral body. Ureters are also easily identified in modern high resolution CT scanners. If there was any doubt about ureteral identification, about 7 ml of intravenous non-ionic radiographic contrast was injected to delineate the ureters.

Selecting the angle and calculating the depth

The axial section through L3 vertebral body is selected. Usually an angle of about 45° (in relation to the horizontal) with plane of the needle parallel to the axial section gives good access through the psoas musculature to the region of sympathetic trunk. The depth from the planned skin entry point to the region of sympathetic trunk is calculated. After planning the trajectory, the point of entry is marked on the skin.

Figure 1: Needle insertion through psoas muscle. Location of sympathetic chain (SC), ureter(U), abdominal aorta (A) and IVC (I) are clearly identified prior to needle insertion (N).

Needle insertion

After infiltration of local anesthesia, a long thin needle (15 or 16 cm; 22 G) is inserted with the angulation,

inclination and depth as calculated. Alternatively the needle can be inserted through a short coaxial needle for added precision. CT scans at the level of insertion (5 cm of coverage) is taken and minor adjustments are made to get the optimum positioning of the tip of the needle (Figure 1 and Figure 2).

Figure 2: Final placement of needle tip. Tip of the needle (N) is positioned posterolateral to abdominal aorta (A) and immediately anterior to lumbar vertebral body at exact location of sympathetic chain (S) for left sided neurolysis.

Infiltration of dilute contrast to know the spread of solution

Dilute radiographic iodinated contrast (2 ml) is injected and CT scans taken to visualize the pattern of spread. If spread of contrast includes the full area of the sympathetic trunk, it is taken as good needle positioning. Also inadvertent vascular or ureteric penetration is excluded by doing this test contrast injection (Figure 3).

Figure 3: Injection of dilute contrast. The spread of contrast (C) in prevertebral region is seen as hyper dense {bright} area.

Injection of neurolytic solution

After clearly confirming the position of the needle tip, about 3 ml of absolute alcohol is slowly injected over 2 minutes (Figure 4).

Figure 4: Injection of absolute alcohol. The injection of absolute alcohol (ALC) produces a hypo dense {dark} focus within the contrast pool.

Final check scans and post procedure observation

A final check CT at the level of injection shows hypo dense alcohol within the hyper dense contrast pool. Successful outcome is immediately recognizable in the form of increased limb temperature and cessation of rest pain. Patient is observed in the adjoining observation room for 30 minutes post-procedure.

After the procedure the intensity of pain, healing of ulcers and claudication distance were assessed at 1 week, 1 month and 2 months.

RESULTS

The age of the patients ranged from 40 to 65 years. Mean age of the patients was 47.5 years. Etiology was TAO in 14 patients and atherosclerotic in 8. Two patients were female (atherosclerotic etiology). 18/22 patients were chronic smokers. There were 5 diabetic patients in the group. Ischemic ulcers were seen in 14 patients.

In 18/22 of patients (82%) there was immediate return of warmth with relief of pain. At the final assessment, 2 months post procedure, 17/22 patients (77%) reported substantial relief of rest pain (>75 % reduction of rest pain as assessed by VAS). Among patients who showed benefit from rest pain, the mean claudication distance increased from nil to 52 meters. Among the five patients who did not show any benefit, three were suffering from chronic diabetes mellitus.

Ischemic ulcers showed significant healing (>50% reduction in size) in 8/14 patients at 2 months post procedure (57% response).

DISCUSSION

Lumbar sympathectomy is a very useful procedure in vascular surgery despite the controversies. At present it is principally used for treating rest pain in patients for whom revascularizations is not feasible. It is also used to treat critical limb ischemia as a last resort with reasonable success.^{4,5}

Open surgical lumbar sympathectomy has been replaced by an endoscopic retroperitoneal approach. However CT guided lumbar sympathectomy is precise, safe and gives equivalent results without the morbidity associated with surgery. When many co-morbid conditions are present, CTLS is an easily performed procedure than the surgical option. Moreover CTLS done at single level (L3) gives equivalent results as CTLS done at multiple levels. 75% of vascular surgical society members in UK and Ireland still continue to use lumbar chemical sympathectomy in their practice.⁶⁻⁸

Many studies have documented the efficacy of CT guided lumbar sympathectomy in treating severe rest pain due to inoperable peripheral vascular disease. In a recent study by Florek R et al, 80% showed significant improvement at 3 months which correlated with our study. However with time some of the early effects may be partially lost due to increased sensitization to circulating catecholamine. Despite this, the overall benefits clearly outweigh the risks. In chronic diabetic patients the benefits are less, compared to non-diabetics.⁹⁻¹³

In critical limb ischemia, it serves as a last resort often preventing imminent amputation or at least postponing the same by years. In a study by Lee BY, Madden JL and others, the long term results for limb and toe salvage were 71% and 51% respectively after 8 years of follow-up.¹⁴

Various imaging techniques have been utilized for guiding needle placement. The oldest technique, namely X-ray fluoroscopy shows only the bony landmarks and hence is less precise. CT scan facility is widely available, shows all soft tissue details in exquisite detail and is precise to about 1 cubic mm. CT fluoroscopy is a hybrid technique, not widely available and does not afford any major advantage. Moreover there might be slightly increased radiation dose in CT-fluoroscopy, compared to routine helical CT. Sympathetic skin response can be evaluated prior to neurolysis to confirm needle placement in sympathetic chain but it may not be necessary, because of the precision of needle tip placement that is possible using CT guidance.¹⁵

Among the reported complications of surgical lumbar sympathectomy, a trivial one was dull aching pain / hyperesthesia in the anterolateral aspect of thigh which usually resolved in a couple of months. Severe complications were ureteric injury. In our series no major complication was reported. Transient hyperesthesia in thigh was seen in only one case. Cases of ureteric injury have been reported in the literature but most of such complications were with X-ray fluoroscopic guidance. Because of the precision and clear identification of soft tissue structures, ureteric complication in CTLS is extremely rare.

The limitation of the study was the small sample size. However the initial results in the Indian scenario are

encouraging. Radiologists doing interventional procedures using CT guidance could easily master this procedure and perform it confidently. Accurate positioning of needle tip is the technique that needs to be mastered

CONCLUSION

Lumbar sympathectomy has still got a specific role in modern vascular surgery practice. It is the last weapon in the hands of the vascular specialist to relieve the patient from intractable rest pain when heroic revascularization is not feasible. In critical limb ischemia it has been shown to save the patient from imminent amputation. The precision of computed tomography guidance in chemical neurolysis is unparalleled. It is safe, as effective as surgical sympathectomy and can be quickly performed as an out-patient procedure with local anesthesia. It is a valuable technique that can be easily mastered by the radiologist doing interventional procedures using computed tomography.

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