

Original Research Paper

Percutaneous Chemical Lumbar Sympathectomy In Diabetic Foot

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ABSTRACT:

Objective: Diabetic foot is a common in outpatient pain management, usually it is complicated with foot ulcer, soft tissue infection, osteomyelitis and wet gangrene which sometimes necessitates wound debridement or amputation of the dead infected part to save the limb and the life of the patient. In this trial we want to find whether chemical lumbar sympathectomy can accelerate ulcer and wound healing, reduce the incidence of amputation. **Material and methods:** We select 53 patients with diabetic foot and foot ulcer in this double-blind study, their age ranging between and their weight between, all have rest pain and claudication. All those patients underwent ultrasound guidance percutaneous chemical lumbar sympathectomy using 5 ml of lignocaine 2% at one vertebral level as a diagnostic agent and 5 ml phenol 7% in another vertebral level as a therapeutic agent. We follow our patients in 3 months, 6 months and 1 year in sense of pain scores, skin temperature, walking distance and rate of wound healing. **Results:** We found Pain scores decreased, skin temperature increase, walking distance till claudication also increased and there is acceleration of ulcer wound healing. **Conclusion:** USG percutaneous chemical lumbar sympathectomy may reduce neuropathic left rest pain, increase skin temperature and accelerate ulcer healing.

Key words: *Sympathectomy, Phenol, Claudication.*

INTRODUCTION:

Diabetic foot recently defined as any pathological process which result from peripheral arterial diseases and /or peripheral sensory neuropathy affecting the feet and/or lower leg in patients with diabetes mellitus. Diabetic foot regarded as one of chronic complication of diabetes mellitus (1). Presence of several pathological process in diabetic foot like infection cellulitis, swelling,

ulcer, gangrene, osteomyelitis and arthritis called diabetic foot syndrome. About (15-30) % of diabetic patients have diabetic ulcer (2) which is the second causative factor for amputation of foot after trauma (3). The signs of diabetic foot are changes in the color (redness, cyanosis, black, pallor), changes in the temperature (hotness, coldness), swelling and edema, pain, sores, blisters, in growing toe nails, corns with callus and cracks. Detailed and proper workup of

patients with diabetic foot infection is important in determining the severity and level of infection process and then starting the appropriate treatment because the appearance of patient with infected diabetic foot not correlate well with the severity of hidden infection so delay in proper management of diabetic foot infection increase risk of infection and increase level of amputation (4). The workup started with taking full thorough history which include past medical, past surgical history, history of drugs, social history of smoking or alcohol intake, duration of diabetes, duration of ulcers, any past history of infection, amputation or ulceration. Patients with diabetes for more than 10 years, long duration of ulceration and past history of complication of lower limb have greater risks of severe infection. Studies also had shown that smoking is a risk factor in development of peripheral arterial diseases which is important factor in lower limb amputation in diabetic patient. (5) Then we do physical examination by measuring vital signs (PR BP temperature), those patients with fever and vitally unstable with leukocytosis must be admitted to the hospital to start treatment. Sometime patients appear less toxic than the severity of infection. About 50% of patients with diabetic foot are afebrile, nontoxic and without leukocytosis so thorough full examination, laboratory investigation and imaging are essential in diagnosis and determining the severity of infection in diabetic patient. (6) Vascular state of the foot is very important and we must do Doppler study to assess the vascularity of the limb because it is difficult to feel the peripheral pulses in swollen diabetic foot, so Doppler study will reduce the incidence of false positive palpating pulses in diabetic foot. If we hear biphasic or triphasic arterial signal, this mean that distal vascular supply is adequate for healing because his correlate with palpable pulse. Any diabetic patient who has foot infection usually has peripheral neuropathy, so neurological and musculoskeletal examination is essential. The tests which are used are monofilament tests, vibration test and Ipswich test which has 76% sensitivity and 90% specificity in comparison to vibratory and 10 gm monofilament tests at different 6 sites on the foot.(7). Musculoskeletal examination should be done from knee to toes concentrating on deformity, rigidity. Dermatological examination is also essential which must be done on clean skin, we must look for pigmentation and measure the length and depth

of the ulcer which can be measured by metal probe. Studies showed that ulcers deeper than 3 mm and has surface area larger than 2 square cm are associated with high incidence of osteomyelitis and has high risk of amputation (8). Then we must do examination of skin area surrounding the ulcer for induration, erythema and crepitation. Presence of crepitation in area surrounding the ulcer is indication of serious infection with gas forming organisms and we must transfer the patient to the theater for immediate surgical intervention. probing of the wound is important because if you reach the bone in the base of the ulcer this mean there is osteomyelitis, if not this rules out osteomyelitis (9). Investigation is important, we start with complete blood count CBC with differential, ESR and C reactive protein. Usually, hemoglobin is low in diabetic foot infection with chronic osteomyelitis and sometimes necessitate blood transfusion. Half of diabetic patients who have moderate to severe foot infection but has normal WBC count, if those patients have leukocytosis, this indicates the presence of deep abscess or necrotizing infection (6) Hyperglycemia may be the only marker of presence of moderate or severe infection in diabetic patient. Measurements of serum electrolytes is important because hypo or hyperkalemia may be present in diabetic patient and need correction preoperatively. Usually, those patients have renal impairment with diabetic nephropathy so blood urea and serum creatinine are important before surgery and before starting antibiotics. Erythrocyte sedimentation rate ESR, C reactive protein CRP, procalcitonin and HBAIC are important to measure in diabetic patients. ESR increase in many cases like infection, tumor, inflammatory diseases, age, myocardial infarction, pregnancy, oral contraceptive pills, obesity and trauma. ESR above 70 in diabetic patients is indicator of presence of osteomyelitis. (10) C reactive protein is a polypeptide that synthesized in the liver and increased in inflammatory and infectious diseases, its normal value is less than 6 mg/L, but its use as predictor in diagnosis of severe infection and osteomyelitis in diabetic foot has not been considered because of wide range of optimum cut off value(3-100)mg/L for the diagnosis of osteomyelitis, so its value has been used as supportive measure with other laboratory tests and other imaging studies (11). Procalcitonin is a hormone is more specific for severe bacterial infection, its normal level is less than

0.1 mg/ml, so we expect its level to increase in diabetic foot ulcer or osteomyelitis, but some studies found that elevated value of procalcitonin is not supportive in cases of diabetic osteomyelitis and in doing all these inflammatory tests, elevated ESR remain the only laboratory test which play important role in diagnosis of diabetic osteomyelitis. (12). Hemoglobin A1C (HbA1C) which give estimation of daily blood glucose in the last 120 day is another important marker which give predictive value of healing in diabetic foot ulcer. Some trials show decrease in rate of wound healing by 0.029 square cm for each one percent increase in HbA1C level above (6.5-7) % which decrease to 0.022 square cm in presence of neuropathy (13). Assessment of nutritional state of diabetic foot patients with ulcer is important as they are usually malnourished and adequate nourishment is important for wound healing. Albumin more than 3.5 gram/liter is associated with rapid wound healing. Prealbumin more than 15mg/dL is also good predictor of response to treatment in patients with sepsis and we can reassess prealbumin every 2-3 days because of its short half-life(2-3day), if there I increase in prealbumin level, this indicate that about 65%of nutritional requirement was provided (14). Then we must take swab from the depth of the wound and sent it to gram stain, aerobic, non aerobic culture and sensitivity and if infection is old and more than 180 days, we must consider sending swab for fungal culture. The most important step in managment of diabetic ulcer is imaging studies, so take plain x ray better for both sides using the normal side as control. The presence of osteolysis or decrease in bone density indicate osteomyelitis which need 50% reduction in bone density to diagnose osteomyelitis. It takes 11- 14 days for the first bone changes which called periosteal to be clear on x ray imaging (15). MRI of foot is the best imaging test for diagnosis and follow up with sensitivity

of 90% and specificity of 78%. We usually do not depend on history, physical examination, lab studies, imaging studies alone in diagnosis and determine the severity of osteomyelitis but we depend on combination of all the above investigation to determine the severity of infection and whether we can treat the patient medically or surgically.

PATIENTS AND METHODS:

53 patients with proved diabetic foot were selected for this study which was double blind trial. Age of patients were between 64 to 84, their weight was between 65 to 84, 39patienta were male and 14 patients were females. Refusal to be enrolled in the study, neurotic patients, psychotic patients, patients who are allergic to local anesthetic agents &/or phenol, patients with coagulopathy, patients with high blood urea and serum creatinine (severe diabetic nephropathy), patients who had infection source on their flanks were excluded from the study. After finishing the work up, we explain the steps, the results and the expected complication of the procedure, all patient signed the research forms. Patients were admitted to surgical theater, we insert intravenous line and start IV fluid then we do full monitoring of the patient (PR, BP, SPO2, ECG then we return the patient to lateral side with side intended to operate was up, did cleaning and sterilization with povidone and alcohol. We start the procedure with ultra sound to insert the chiba echogenic needle 15 cm long then we ensure the position of the tip of the needle by c arm screen which must be in anterolateral side of the body of the lumbar vertebrae then we inject one ml of dye to notice its distribution which must be longitudinal along the course of the sympathetic chain. We usually did block at two levels L1, L2, L3, L4. Then we inject 2 ml of lignocaine 2% in one needle as a diagnostic test and then inject 5 ml of phenol 7% in the second needle.

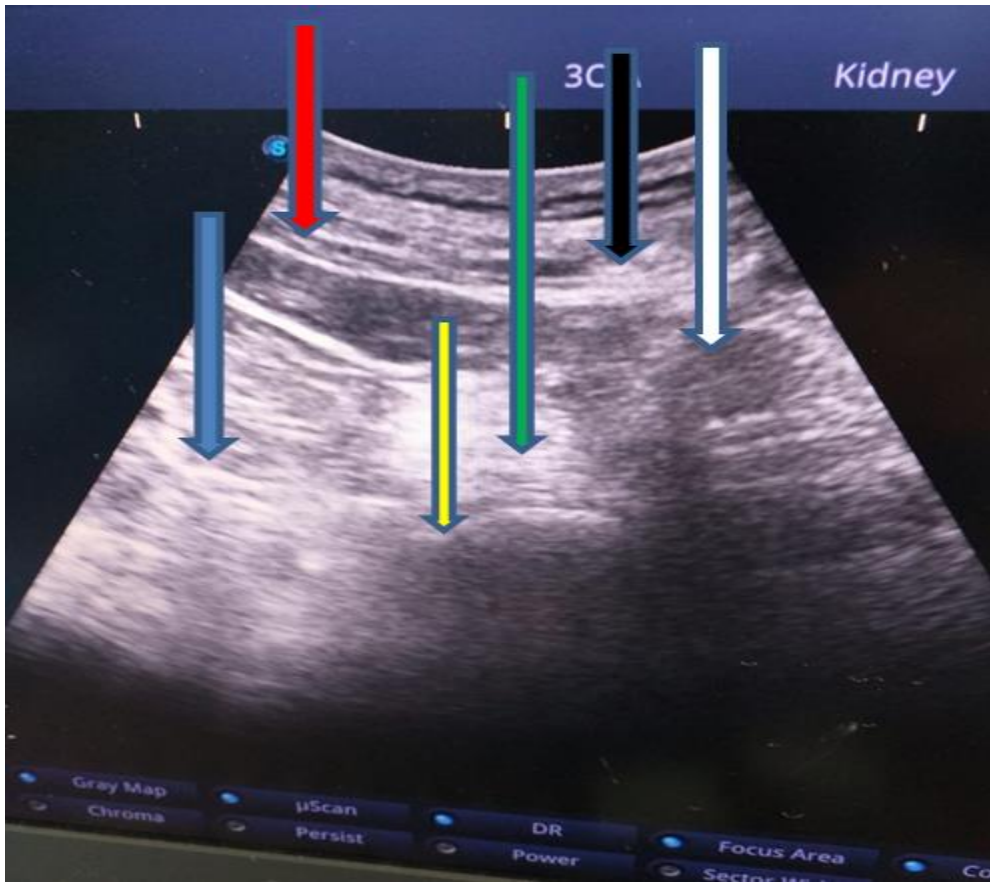
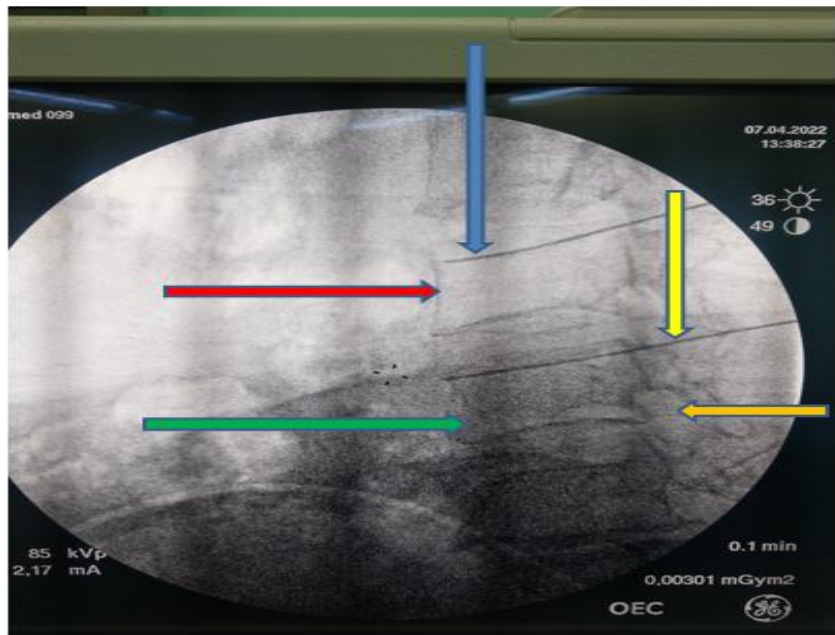


Figure (1): Ultrasound picture in lumbar sympathectomy after insertion of chiba needle. Yellow arrow is anterolateral border of lumbar vertebra. Blue arrow is kidney or other retroperitoneal structure. Red arrow is latissimus dorsi and quadratus lumborum muscles. White arrow is transverse process of lumbar vertebra. Black arrow is the needle trajectory.



Picture (2): X ray picture in lumbar sympathectomy to confirm the position of the tip of the chibba needle. Red arrow is the anterolateral border of second lumbar vertebra. Green arrow is anterolateral border of third lumbar vertebra. Blue arrow is the position of first chibba needle. Yellow arrow is the position of the second chibba needle. Orange arrow is the intervertebral foramen through which L3 root pass

Sample size: As in all our researches, we take the confidence level as 95% and take the confidence interval as 10%. According to the table of Z scores, 0.95 is equal to 1.96 (this is the Z value). In our hospitals pain clinic, the prevalence of diabetic foot is about 10% (so p value is equal to 0.10). $Q=1-p$, so $Q=1-0.10=0.90$, so $PQ=0.10*0.90=0.09$. After squaring of the Z value the result will be $1096*1.96=384.17$. After multiplying the square of Z value with PQ, the result is $384.17*0.09=34.575$. After all these equations, we must select at least 35 patients in this study. So, we collect 53 patients because some patients will drop from the study either because of exclusion criteria or some time we cannot follow up some patients. Statistical analysis: After taking and collecting data from patients who are

involved in the trial in sense of WT age pain scores, skin temperature, ABIetc. in 0 tie, 3 months, 6 months and 1 year after treatment, we use statistical package for social sciences (SPSS) to correlate the results which were expressed as mean, standard deviation. We use the paired samples test to compare the results of quantitative data.

RESULTS:

As shown in table 1, The mean age is 65.7 ± 14.1 years and in terms of weight it is 77.8 ± 13.4 Kg. Most of patients were males. While Table 2: illustrates the findings in terms fo the chosen parameters which are rresults in terms of pain, temperature, walking distance and ABI. All the parameters have shown to be highly significant.

	Mean	Standard Deviation
Age	65.735	14.188
Weight	77.811	13.419
gender (male/female) =34/19		

Parameters	Mean	standard deviation	P value	significance
Pain preop	7.83	0.848	0.001	
Pain 3 months postop	2.339	0.875	0.001	HS
Pain 6 months postop	2.622	0.627	0.001	HS
pain 1 year postop	2.547	0.748	0.002	HS
Skin temp. pre-op	34.226	0.538	0.001	HS
Skin temp. 3 months post-op	36.226	0.496	0.001	HS
Skin temp. 6 months post-op	36.388	0.655	0.001	HS
Skin temp. 1-year post-op	36.384	0.452	0.001	HS
Walking distance Pre-op.	35.37	1.874	0.001	HS
Walking distance 3 months postop	81.169	19.231	0.001	HS
Walking dist.6 months postop	99.15	24.073	0.001	HS
Walking dist.1 year postop	111.226	29.692	0.001	HS
ABI preoperative	0.59	0.23	0.001	HS
ABI 3 months post-op	0.864	0.1	0.001	HS
ABI 6 months post-op	0.9	0.087	0.001	HS
ABI 1-year post-op	0.911	0.155	0.001	HS
HS= high significance				
ABI= Ankle brachial blood pressure index				

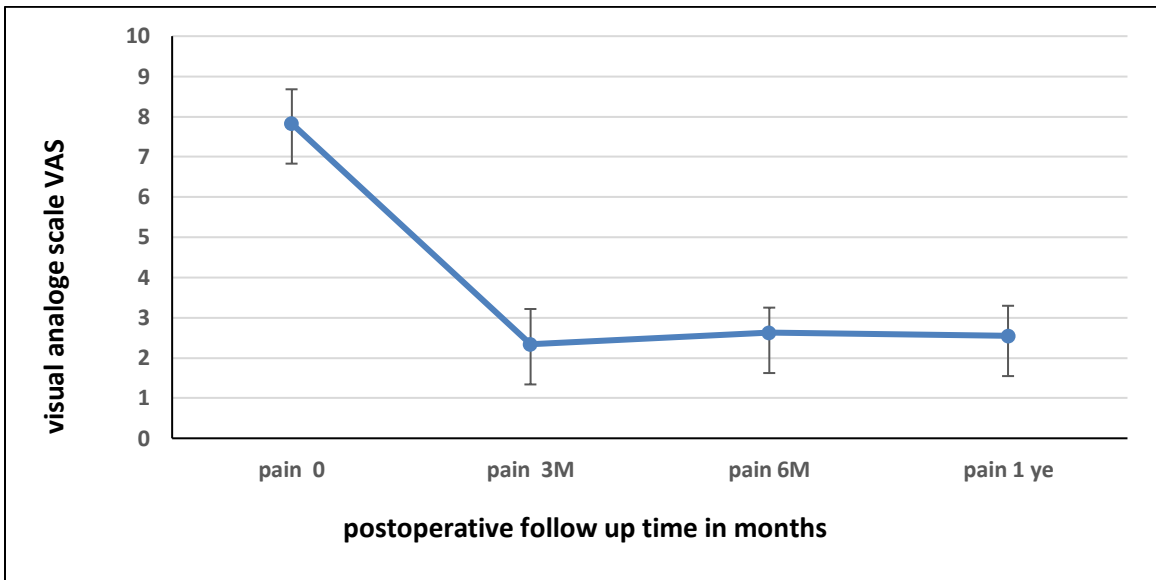


Figure 3: Pain scores of lower limbs

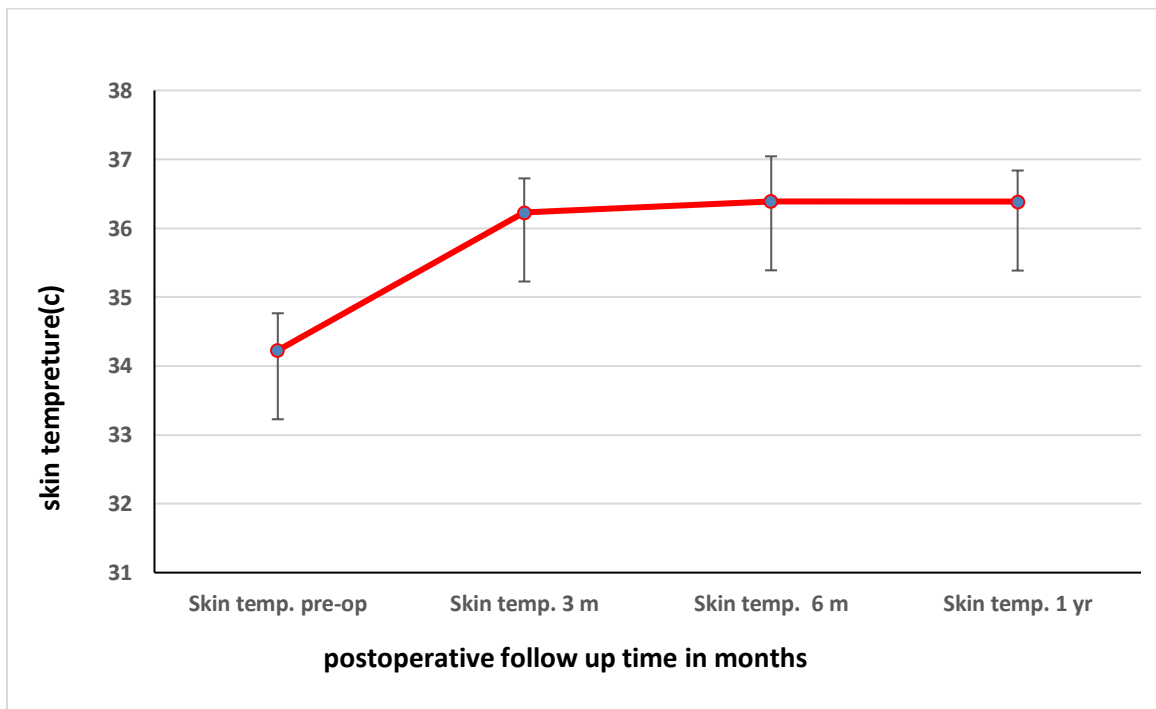


Figure 4: skin temperature of lower limb gets higher with time in the post operative follow up time.

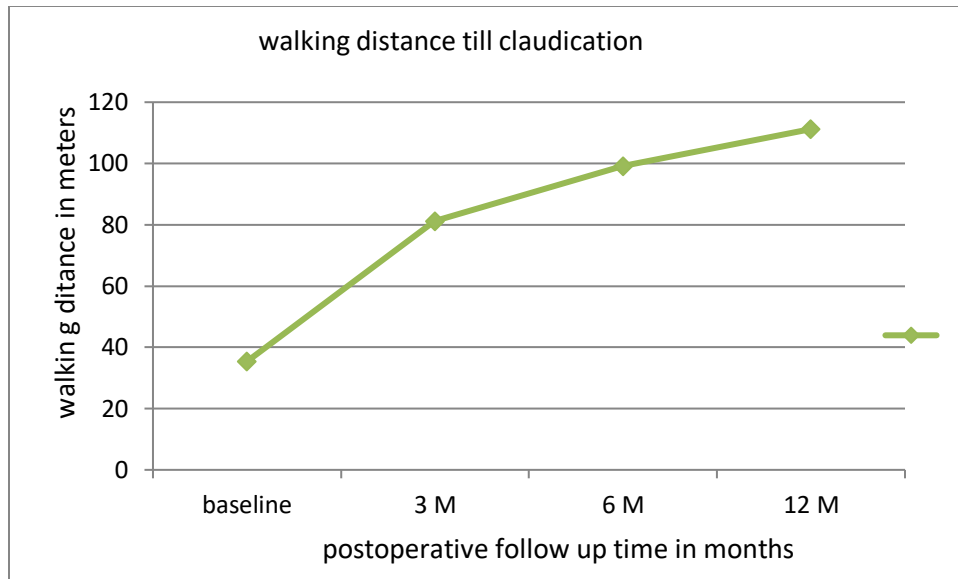


Figure 5: walking distance till claudication increases with time in the post operative period follow up time.

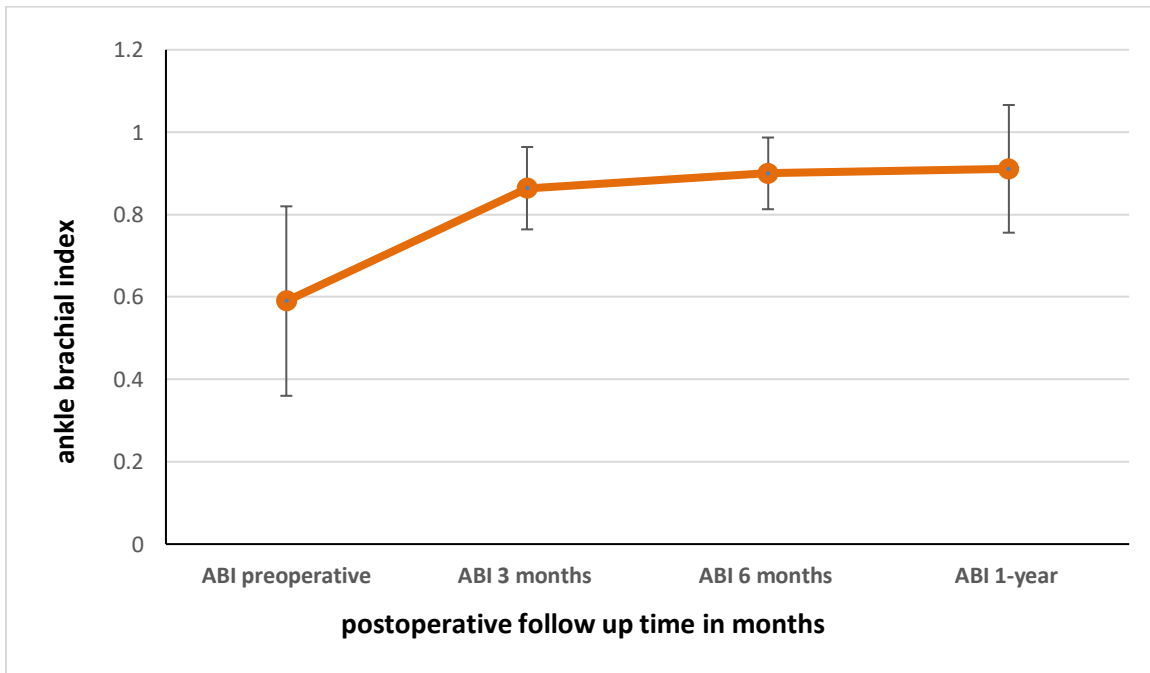


Figure 6: Ankle brachial index of affected limb lower limb. Increases with time in the post operative follow up time.

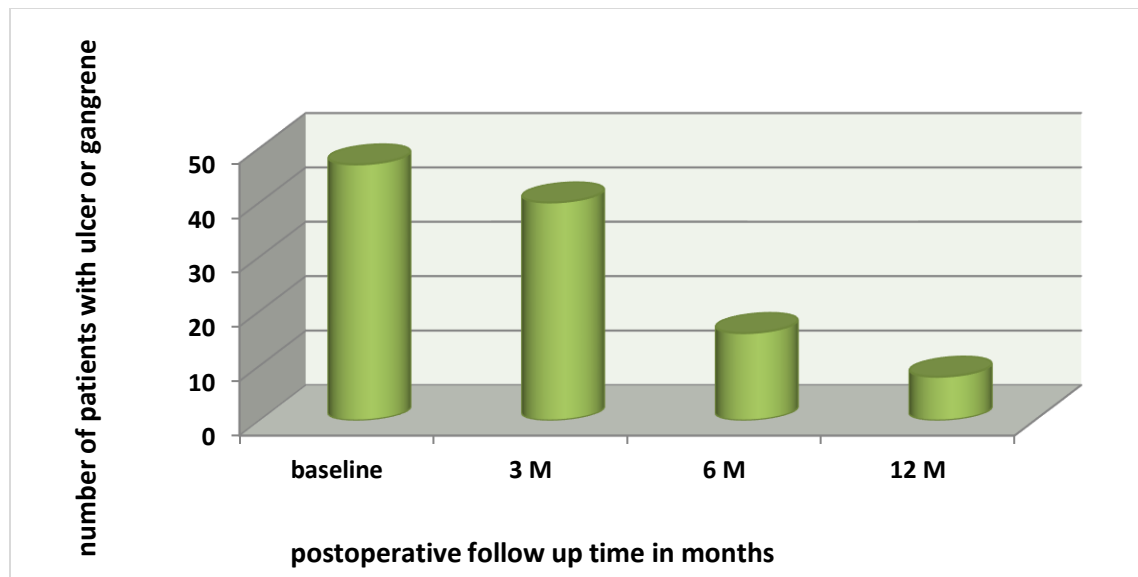


Figure 7: Patients with ulcer or gangrene. The number decreases with time in the post operative follow up time.

DISCUSSION

In our research we found that diabetic patients with diabetic foot ulcer and gangrene or neuropathic pain who underwent USG lumbar sympathectomy has good pain relief, increase skin temperature, improve walking distance and accelerate ulcer healing. Our finding was similar to study done by M. Chakoval and his or her colleagues who did lumbar sympathectomy on group of patients and found that this procedure reduce neuropathic pain, increase skin temperature, facilitate diabetic ulcer healing and reduce incidence of amputation. (16). YUE WU and his colleagues did their trial on 85 patients with diabetic foot ulcer and gangrene, all those patients did chemical lumbar sympathectomy, they found that this operation reduce pain scores, increase skin temperature, increase walking distance and facilitate ulcer wound healing. In addition to that they use contrast enhanced ultrasound assessment of blood flow in calf muscles. They examined the patients immediately before operation and one month after the operation, they concluded that if blood flow reaches its peak quickly, those patients have good results in pain relief and increase in skin temperature in six months and one year postoperative. They found that there is a relation between the preoperative time to peak response in contrast enhanced ultrasound examination of calf muscle and the pain scores and skin temperature postoperatively (longer time to peak was associated with poor pain relief response and temperature response after sympathectomy with sensitivity of 81.5% and specificity

of 87.9% and conclude that preoperative time to peak can predict the therapeutic beneficial effect of chemical sympathectomy. (17) Anurag Chahal and his colleagues in their trial of CT guided lumbar sympathectomy on 30 patients with chronic limb threatening ischemia in lower extremities with diffuse arterial stenosis not fit for revascularization using absolute alcohol. They use numeric pain scores and skin ulcer size as parameters and was assessed preoperative, 3 weeks, 3 months, 1 year, and 2 years postoperatively. In regards to spread of alcohol, patients were divided into medial spread group and lateral spread group using the anterolateral edge of the lumbar vertebra as a reference point. They found the pain scores pre-op, 3 weeks, 3 months, 1 year and 2 year were 7.31, 2.95, 2.47, 2.1, and 2.04 in medial spread group while in lateral spread group were 6.25, 4.13, 4.50, 4.35 and 4.32 with p value <0.001. the reduction of foot ulcer and the limb salvage were 100% in medial spread group while it is 87.5% in lateral spread group. Also found that after 2 years 16 patients in medial group and 2 patients in lateral group show clinical improvement with p <0.001. So, they conclude that CT guided lumbar sympathectomy with alcohol is safe and effective method in reducing pain and accelerate ulcer healing when the neurolytic agents spread medially (18). Holiday f A and his colleagues who did 76 lumbar sympathectomy on 70 patients, 36 case were done by open surgical method and 40 sympathectomy was done as fluoroscopy guided percutaneous chemical sympathectomy. They found after one year of follow up

the success rate was 47% in the surgical patients and was 45% in less invasive percutaneous patients and the P value was 0.2 of no significance. Also, they found the limb salvage was 61% in surgical sympathectomy group and it is 58% in percutaneous sympathectomy group with p value was 0.18 of no significance and so they conclude that there is no difference between surgical and less invasive percutaneous sympathectomy group. They also found that percutaneous chemical sympathectomy has shorter duration of staying in the hospital and less mortality rate than surgical sympathectomy (19) Manjunath PS and his colleagues who did their trial to compare the safety and efficacy of percutaneous radiofrequency thermal lumber sympathectomy and percutaneous chemical lumber sympathectomy using phenol 7% on 20 patients. In both these two groups there were good and significant lumber pain scores reduction but there is no significant statistical difference in mean of pain scores of the two groups. In addition to that radiofrequency is expensive while phenol is cheap, so radiofrequency lumber sympathectomy is comparable to phenol lumber sympathectomy.(20)

CONCLUSION:

Doing ultrasound and c arm guided percutaneous chemical lumber sympathectomy in diabetic foot patients is essential, cheap, easy, less invasive technique in reducing neuropathic pain and accelerate ulcer wound healing.

Recommendation:

I ask all my colleagues in pain medicine to do percutaneous chemical lumber sympathectomy using ultrasound and c arm screen to guide the needle and to use phenol 7% as neurolytic agent in any diabetic foot patients and to do more researches on big sample size and to follow for more longer period of time and in multiple medical centers.

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