

# Effect of Neuromuscular Electrical Stimulation in Patients Diagnosed with Varicose Vein: A Brief Review

Komal Dahiya<sup>1</sup>, Gitanjali Sikka<sup>2</sup>, Madan Gopal Vashist<sup>3</sup>

<sup>1</sup>Student MPT Cardiopulmonary, College of Physiotherapy, Pt. B.D. Sharma University of Health Sciences, Rohtak, India

<sup>2</sup>Assistant Professor, College of Physiotherapy, Pt. B.D. Sharma University of Health Sciences, Rohtak, India

<sup>3</sup>Senior Professor, Department of Surgery, Pt. B.D. Sharma University of Health Sciences, Rohtak, India

Corresponding Author: Komal Dahiya

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## ABSTRACT

Varicose vein is one of the common vascular abnormalities in the world. Patients with varicose veins are at high risk for developing deep vein thrombosis. Various physiotherapy modalities such as muscle stimulator, pneumatic compression, ultrasonic, TENS can help in the management of pain and Improves quality of life in these patients. Various studies have supported that neuromuscular electrical stimulation (NMES) could improve pain and quality of life (QOL) in patients with varicose vein. Purpose of this review is to know about the role of NMES in the management of varicose vein. Several studies showed that NMES helps in decreasing pain and improves QOL in patients with varicose vein. Till date there is no definitive protocol for NMES as treatment modality in varicose vein patients. In order to establish a definitive protocol in varicose vein, further research needs to be conducted.

**Keywords:** Neuromuscular Electrical Stimulation (NMES), TENS, varicose vein

## INTRODUCTION

Chronic venous disease (CVD) is the most common problem which can be seen in general population in the present era. CVD can be classified into 3 types i.e. superficial venous insufficiency (SVI), deep venous insufficiency (DVI) and deep venous

obstruction (DVO).<sup>1</sup> 80% of the population is suffering from SVI. Superficial venous insufficiency commonly known as varicose veins.<sup>1</sup>

Varicose veins are also known as varicose or varicosities<sup>2</sup>. These veins are torturous, widened superficial veins which can be visible easily in the subcutaneous tissues of the legs. Varicose veins are enlarged and usually larger than 3mm in size and are present inside the calf muscles.<sup>3</sup> These veins usually have bluish-purple or red colour.

According to American society for vascular surgery, as many as 40 million Americans have varicose veins. Statistics further show that 15% of men and 25% of women have varicose veins. According to American venous forum, an estimated 23% of the US adult population suffers from varicose veins.<sup>4</sup> According to population in India patients with varicose veins in India is about 15-20% of population and increasing day by day.<sup>3</sup>

Veins are blood vessels that carry mostly oxygenated blood towards to the heart. Valves are present in most of the veins that prevent back flow of the blood.<sup>2</sup> varicose veins occurs due to inability of the valves to work properly. The veins permanently lost their ability to carry blood from the legs back up to the heart against the force of gravity. As the blood falls down the legs

and pools due to gravity, the veins overflow giving them their typical unsightly bulging appearance.<sup>5</sup> valvular incompetence is the most common reason for the varicose vein.<sup>2</sup> General risk factors of varicose veins are increasing age, female sex, pregnancy, family history of venous disease, smoking, and overweight.<sup>4,5</sup> Prolonged working in standing position increases the prevalence of varicose vein and is important occupational risk factor. Computer professionals, Nurses, Receptionists, security guards, traffic policeman, salesman, teachers and persons doing desk jobs are the worst sufferers of varicose veins.<sup>4,5,8</sup>

Patients with varicose vein usually presents with itching, leg swelling, leg aching pain, night cramps, paraesthesia, tiredness, heaviness, and prominent palpable and tender varicosities.<sup>6</sup> In ladies, it is much more cosmetic troublesome. Signs of a more serious vascular insufficiency may include changes in skin pigmentation, eczema, infection, superficial thrombophlebitis, venous ulceration, loss of subcutaneous tissue, and lipodermatosclerosis.<sup>7</sup>

Prevention is the key factor for avoiding the further progression of the disease. Measures can be taken to prevent varicose veins such as – avoid sitting or standing for long periods of time, maintain ideal body weight, avoid wearing constricting clothing, participate in a daily walking program, avoid crossing the legs at the thighs, changing position frequently, elevating the legs when tired, and walking up the stairs rather than using the elevator or escalator is helpful in promoting circulation.<sup>4</sup>

Diagnosis of varicose vein is done in patients with symptoms of prominent dark bluish blood vessels, especially in the legs and feet or history of exposure to risk factors. Various physical test like Perthes test, Trendelenburg test can be done for the diagnosis of varicose veins.<sup>8</sup> color Doppler

examination is the best method for making correct diagnosis about varicose vein. Duplex ultrasonography is a simple, noninvasive, painless and readily available modality that can assess the anatomy and physiology of the lower extremity venous system.<sup>7</sup>

Treatment options for varicose veins include : conservative management, medical therapy, external laser treatment, injection sclerotherapy, endovenous interventions, and surgeries.<sup>9</sup> conservative measures include compression ( bandages, support stockings, intermittent pneumatic compression devices), elevation of affected leg, lifestyle modification etc.<sup>7,9</sup> Physical therapy can also play an important role in preventing disease progression and optimizing results of surgical and pharmacological treatments. Therapeutic modalities like TENS, NMES, ultrasound help in recuperating blood circulation and help in relieving pain, resisted exercise with theraband help in strengthening the muscles of legs, elastic stockings maintain constant pressure and improve blood circulation, contrast bath one of the best methods to relieve pain.<sup>8</sup>

### **Role of NMES (Neuromuscular electrical stimulation) in varicose vein patients**

NMES is safe, well tolerated modality that increases venous blood flow parameters by artificially activating the muscle pumps of the lower limb.<sup>10</sup> NMES refers to the use of electrical impulses to elicit muscle contraction. NMES increase venous blood flow parameters by artificially activating the muscle pumps of the lower limb in healthy individuals and patients with CEAP C2-C4 CVD.<sup>11,12</sup> NMES utilises transcutaneous electrodes to cause muscle contraction either by activating the muscle itself, or the nerve supplying a muscle group.

Authors, Journal, Year	Objectives	Design	Characteristics of participants sample size	Methods	Outcome measures	Results	Limitation
Breen et al.2012 <sup>12</sup>	Comparison of single and two channel neuromuscular electrical stimulation sites for enhancing venous return	Experimental study	10 healthy volunteers (9 males, age 24.9±3.54, BMI 23.8±1.84) were recruited from the local student population.	Two channel NMES sites, NMES was applied	Doppler ultrasound measurements of venous blood volume expelled and peak venous velocity in response to various single and two channel applications of NMES were taken for each subject.	It was found that stimulation of soleus muscle is the most effective single channel stimulation technique and stimulation of soleus and tibialis posterior is the most effective two channel stimulation technique	Limitation of the study is that all the muscles were not tested during the study . Testing order was not randomized
Ravikumar et al. 2020 <sup>13</sup>	A randomized controlled trial of neuromuscular stimulation in non-operative venous disease improves clinical and symptomatic status	Randomized controlled trial	76 patients were enrolled in the study.	Subjects divided into 3 gp. 1 ,30min. session of stimulation was given to 1 gp. and 2 ,30min. session was given to other gp. and 3 gp was control gp	Primary outcome was percentage change in femoral vein time average mean velocity (TAMV). Clinical severity scores, disease specific and generic QOL were assessed.	Study concluded that daily NMES usage increases flow parameters, with twice daily usage improving QOL and clinical severity at 6 weeks in chronic venous disease patients.	Limitation of the study includes short trial duration of 6 weeks. This study did not specifically assess lifestyle or working habits.
Alaa et al. <sup>9</sup>	Effect of neuromuscular electrical stimulation on varicose veins in postpartum women.	Randomized control trial	30 participants females complaining varicose veins participated.	Patients were randomly distributed into 2 gp. Gp A was control gp. Lifestyle modification advices. NMES was given to gp. B 3 times per week for 4 weeks.	Doppler ultrasound device record peak popliteal vein velocity and CIVIQ - 20 for QOL.	Findings reveal that NMES can increase vein velocity, improve symptoms and QOL.	Limitation of the study was sample size was small.
Jehannin et al. 2020 <sup>14</sup>	A systematic review of lower extremity of walking impairment in peripheral artery disease (PAD).	Systematic review	5 studies eligible for inclusion were identified, of which 2 were randomized controlled studies.	3 types of electrical stimulation have been used: NMES, TENS, functional stimulation. Treatment duration ranging from 4-12 weeks.	Primary outcomes were painfree walking distance/ maximal walking distance.	No clear conclusion can be drawn regarding the efficacy of lower extremity electrical stimulation for the management of impaired walking function in people with PAD.	Limitation of the study was that method of assessment was not clearly described and lower extremity stimulation was only tested on people with PAD and sym.of intermittent claudication
Das S.K. et al. 2020 <sup>15</sup>	Neuromuscular stimulation of the common peroneal nerve increases arterial and venous velocity in	Experimental design	14 outpatients with venous leg ulcer enrolled in the study.	1 HZ intermittent electrostimulation of the common peroneal nerve was applied to 14	Duplex ultrasound was done for measuring the flow in the popliteal vein and artery.	Significant increase was observed in both venous and arterial blood flow in the lower limb.	There was no randomization in the study and does not follow patients up in the long term to establish

	patients with venous leg ulcers			patients with ulcers between 1 and 10cm in diameter.			the effect of NMES on healing or recurrence rates of venous leg ulcers.
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## CONCLUSION

NMES increases venous blood flow parameters by artificially activating the muscle pumps of the lower limb. NMES use electrical impulses to elicit muscle contraction. NMES increase venous blood flow parameters by artificially activating the muscle pumps of the lower limb. NMES utilizes transcutaneous electrodes to cause muscle contraction either by activating the muscle itself, or the nerve supplying a muscle group. Several studies have shown that NMES activate calf muscles and helps in decreasing pain and improves QOL in varicose vein patients. Due to multiple limitations in studies conducted till date, no definitive protocol of stimulation in patients with varicose vein could be framed. In order to establish a definitive protocol in patients with varicose vein, further research needs to be conducted.

### Declaration by Authors

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