
Evaluation of Varicose Vein Prediction and Accumulation Reduction Using Artificial Pressure Generation

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Abstract: In this modern world, people are growing more sedentary. This is indeed a phrase that relates to the decrease in physical activity. This decreases the overall oxygen concentration within their bodies. As a result, their artery cells are stimulated, resulting in spider veins. This mostly affects our lower limbs, but it can damage any part of our body. This condition, called "spider vein" or "varicose vein," develops whenever a vascular artery clogs, and it is often highly uncomfortable. Depending on the outcome of the investigation, the data obtained is employed to construct a predetermined database. The pre-configured information serves as a prepared lower limit. This component would analyse the information about a person's location. Seating, knee flexion, and motions throughout the duration are all information which should be examined. This accumulation data can also be processed in the Arduinomicro-controller (98dB) with the use of an EMG CMMR electrode. It is a non-invasive varicose veins diagnostic and treatment procedure that depends upon artificial vibration production. This device will contribute to both a cost effective and user friendly, there the efficiency of device compared with the several other therapeutic approaches. Patients caused by varicose veins can use this device that is healthier than the most of other clinical treatments.

Keywords: Artificial Intelligence, Non-invasive, Lower Extremities, Vascular Epithelial Cell, Varicose Vein, Thrombophlebitis

1. Introduction

Varicose veins are swollen, enlarged capillaries that develop on the legs and feet. This happens when the blood flow is disrupted on a frequent basis. If there is discomfort, these veins also have to be treated for health reasons, but if there is swelling, hurting, and painful legs, the veins need to be treated. Surgery, ligation and stripping, sclera therapy, radio frequency ablation, endogenous laser treatment, and transilluminated phlebectomy are all options for varicose vein treatment. Because the veins contain one-way valves, blood can only flow in one direction [10].

As the vein membranes expand, the valves may become weaker and less flexible (elastic). Blood could bleed backwards and eventually flow in the opposite direction when a valve is damaged. When this happens, blood could build up in the veins, causing them to swell and expand. This could

occur as a result of pregnancy, advanced age, constipation, tumours, or being overweight or obese [4, 7].

Nearly half of the population over the age of 40 has varicose veins of some kind. Adults with severe varicose veins make up 10% to 20% of the population, with 0.5 percent having superficial varicose veins with persistent venous and rupture. This particular decade, nearly 10 million people in India were impacted. The Edinburgh Venous Study (EVS), which looked at approximately 1500 people in the India, found about 39.7% of men and 32.2 percent of women had a dilated tortuous trunk of the long or short superficial veins and their first or second-order branches. In India, the number of varicose vein cases is expanding at an exponential rate, and it has become obvious that venous thrombosis, varicose veins, and venous disorders are as common as they are everywhere else. Most patients having primary varicose veins that appear in the outpatient department have signs and symptoms that are examined. Throughout this research,

males were found to have the highest incidence of varicose veins when compared to females. Just 12.5 percent of the participants had a family history of varicose veins. Patients had a variety of symptoms, with dilated veins being the most prevalent (37 patients, or 92.5%), followed by aching discomfort (22 patients, or 55%). Blood flows in a retrograde direction when a vein is damaged. It deoxygenates the blood and changes the color of the blood [11].

1.1. Literature Review

Yapei Zhao investigates using the MSDCNN algorithm, which is founded on using vascular endothelial cells for accounting information images and multi-scale machine learning. According to Ruizong Zhu and Huipingniu, researchers gathered photographs of vascular endothelial cells from patients who had varicose veins in their lower limbs and normal people, and convolution layers retrieved multi-scale features from vascular endothelial cell pictures. This MFM operational amplifier was employed to develop a competitive mechanism that extracts more condensed data while also lowering internet protocol parameters. This system employs a 33% convolution kernel for increased system extraction of features, as well as an 11% convolution kernel for dimensionality reduction to optimize system parameters still further [6].

Its problem of palm-vein recognition based on RGB color photographs is examined in this section [2]. This will be the first assessment of palm-vein identification using RGB pictures, compared to conventional palm-vein approaches based upon infrared (IR) or near-infrared (NIR) pictures. Image enhancement, vein region detection, and feature matching are the three production phases in the suggested protocol. This image enhancement phase basically increases the contrast of the palm veins, making them extra visible [5]. Following that, the lines of the palm veins were recognized to use a simple Gabor filter, which would then be projected perfectly to remove noise. Then, this hammering length is used to compare those generated binary patterns [15].

This programme appears to have an identical error rate of 0.875 percent and is mostly accessible through the public PolyU database, which consists of four channels: Red, Green, Blue, and NIR. This finding demonstrates the viability of employing RGB pictures in palm-vein identification.

Radiofrequency ablation of the superficial venous system (O.) was one of the cornerstones of minimally invasive therapies for varicose veins and chronic venous insufficiency [8]. These treatments have a high success rate and few side effects. For obese patients, radiofrequency total destruction of the subcutaneous veins could be the best option.

1.2. Existing Diagnostic Techniques

Various procedures, such as infrared image enhancement, scanning, and physical inspection, are used to identify this varicose vein. An ultrasound was needed to determine if the veins were normal and if there were any blood clots in the lower region. That operator applies a transducer against the

skin over the area of the body to be checked under this non-invasive examination. This transducer's function is to transmit the images to the display for analysis [1, 13]. Through the use of deep learning methods, image processing is performed to analyze the vein. One of the conventional treatment options for all these cases was SURGERY. That essential requirement requires typing and pulling from small vein branches. However, these give the patient great agony and require a long time to recover from.

2. Analysis of Spider Vein Symptoms

- 1) Legs are too heavy
- 2) Aching
- 3) Burning
- 4) Throbbing
- 5) Itching
- 6) Muscle cramps
- 7) Legs that are restless

2.1. Sclerotherapy

Throughout this treatment, our doctor can prescribe a substance and foam into tiny and medium-sized varicose veins, scarring and closing them. Varicose veins that were cured should disappear in a few weeks. Sclerotherapy is effective if done correctly, but the same vein might have to be injected numerous times. Sclerotherapy does not require an anesthetic and could be done in the privacy of your own home or at a clinic or hospital.

2.2. Foam Sclerotherapy on Huge Veins

Another technique for shutting and sealing a vein would be to insert a foam solution into it [12].

2.3. Laser Treatment

Smaller varicose veins and spider veins would be treated by specialists utilizing contemporary laser technologies. The vein was healed by focusing intense bursts of light on it, causing it to shrink and dissolve in a short period of time. There were no surgeries or needles necessary.

2.4. Cannula Techniques Involving Radiofrequency or Laser Energy

In these treatments, our surgeon inserts a thin tube (canal) into an enlarged vein and uses radiofrequency or laser energy to warm the tip of the cannula. The energy from the tube causes the vein to shrink and close itself, destroying it. For thicker varicose veins, this operation is the best option.

2.5. High Ligation and Vein Separating

These procedures entail breaking a vein just before it connects to a large vein and then removing it with minor surgery. This is an outpatient procedure for the most part. Because veins deeper in the leg manage a large volume of

blood, eliminating the vein would not block blood from circulating into the leg.

2.6. Ambulatory Phlebotomy (Fluh-BEK-Tuh-Me)

Small varicose veins were treated through a series of minor skin punctures by our doctor. Only the portions of our legs that are being pushed are calmed by the outpatient treatment. Scarring is typically minor.

2.7. Endoscopic Vascular Chemotherapy

When alternative treatments fail, patients might need that procedure only in a severe instance of ulceration. With the use of a microscopic recording device inserted into our leg, the operator visualizes and closes varicose veins before destroying them with little wounds. This surgery is conducted on an outpatient basis.

3. Methodology

While venous hypertension would be the major factor that predisposes people to venous stasis veins, measuring foot venous pressure was thought to be beneficial for assessing lower extremity venous stasis veins. They used vascular pressure to determine varicose vein aggregate discomfort in this investigation. The measurements investigated are proportional decreases in leg venous pressure for manual stress cuff contraction (point low), rate of development in foot vascular resistance during a three-second period following pressure relaxation, and time until 50% recovery of leg venous hypertension.

This study also deals with examination, assessment, and the use of electrical impulses generated by muscles. The myoelectric signal, which would be formed by tiny electric currents generated by the exchange of ions across the muscle membrane and measured using electrodes, is produced by tiny electric currents that have proved useful by muscle activation. Electromyography is a technique for measuring and monitoring the electrical impulses generated by human muscle fibres. Electromyography is the name given to the instrument that records the EMG signal as well as the file that is created as a result of the recording [3].

Among both real-time measured data and NIBP, these pressure regulators have been used to examine and categories their necessary requirements. Venous hypertension was also calculated. This measurement device was used to create the required specifications to handle the pressure after it dropped below a certain level.

The results of the calculations were converted into an overall average, which was then saved in a database for future use, along with pressure readings taken from the leg that had to meet the required standard. Unless the condition's venous hypertension value was decreased, the normal pressure in the human leg is 120 bp. The algorithm repeatedly calculates that pressure and activates the artificial pressure generator.

3.1. Proposed Model

Flow chart

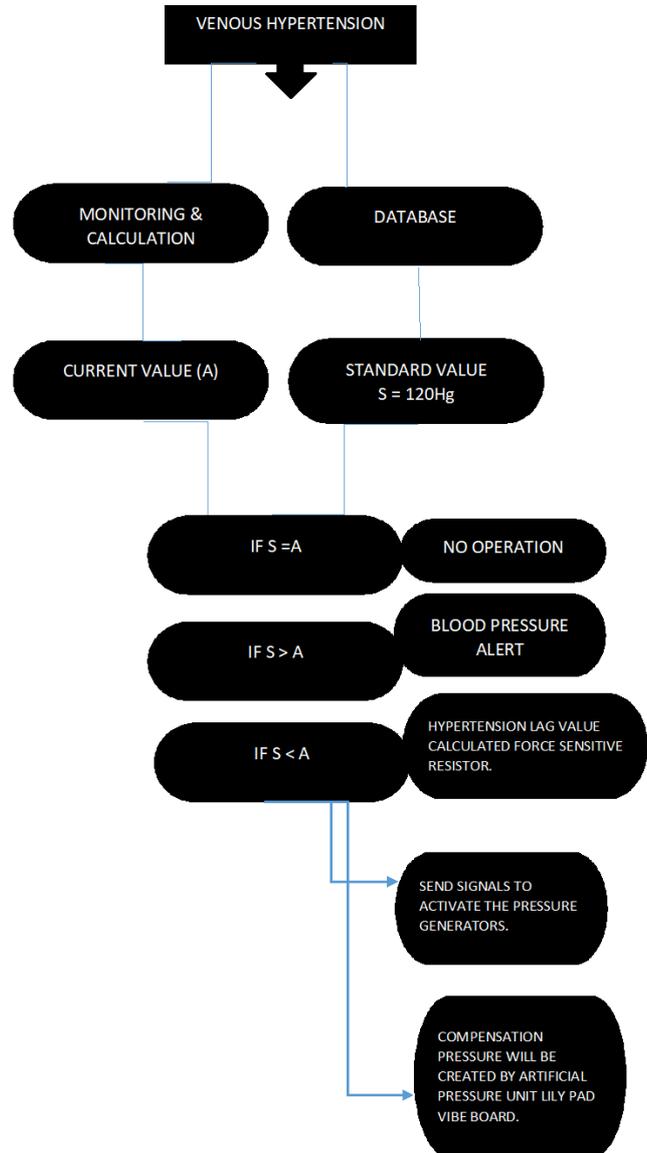


Figure 1. Process of the Hypertension calculation and compensation pressure generation.

To avoid varicose vein trouble, doctors should first understand where the pressure is developing inside the leg. This should provide us with an artificial pressure which will enable them to regulate that pressure on the leg. They should estimate the actual pressure on the leg in this investigation as well as compare it to the normal pressure that develops in the leg region. If the pressure was lower than usual, this system uses EMG signals to find the actual value, and then the artificial pressure generator increases the pressure to compensate for the difference [9, 14].

As shown in the diagram above, we have observed the emergence of hypertension and, depending on the EMG value; our module creates artificial vibration to create an unnatural pressure in the lower leg region. It can provide a robust signal if

the pressure is computed using the CMMR 60Hz Disposable type EMG electrode (96db). This EMG signal was analyzed using the signal graph matching procedure, and it will be compared to a database that has already been created in order to increase accuracy. This is a signal mapping process, and the peak coordinates will be translated. This would aid in the improvement of diagnostic quality as well as the production of measured results to account for hypertension. Once indications were sent to the artificial pressure generator, it would begin working mechanically till the status had been recovered.

3.2. Specification Analysis

Throughout this investigation, they assessed the overall performance of our proposed modules, which solved all of the primary issues associated with varicose vein development as

well as resulted in a lower disease risk upon implementing them. They provided their models for three different atmospheric conditions since this was also a major element in human blood circulation and pressure building. Table 1 classifies their assessment into "Usually," "Often," and "Ever." Then examine the patient and create our data system using these three claims. They estimate that this material has a higher obtained from the primary parameters of heaviness, swelling, twitching, and itching sensation. Patient is using the modules, they are able to prevent problems such as weight and twitching, as well as reduce the rate of aggregation, all the while sustaining a "medium" atmospheric temperature. In this case, they reduced its 18% accumulation rate by 16.6%. It was eventually found that accumulating components would result in a different set of requirements.

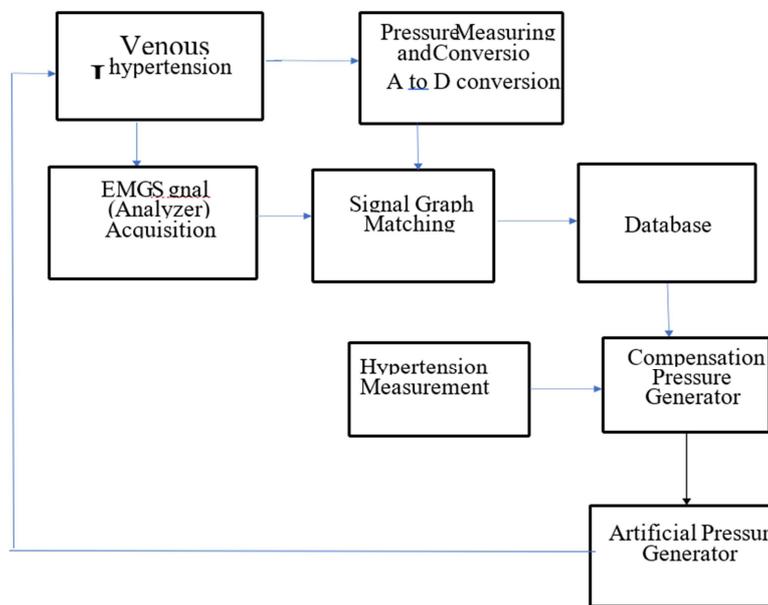


Figure 2. Proposed Block Diagram.

Table 1. Problem Analysis.

PATIENT NAME: Rajesh					Initial accumulation: 17 year old			
Previous treatments: Laser therapy, Regular usage of socks.					Measurement date: 27.02.2021			
Scanning Device: Ultrasound Doppler								
PROBLEMS ANALYSIS (Until the device is used)					PROBLEM ANALYSIS (After the device usage)			
	ALWAYS	SOMETIMES	NEVER	Accumulation Rate (%)	ALWAYS	SOMETIMES	NEVER	Accumulation Rate (%)
HEAVINESS	YES	-	-	14%	-	-	-	-
SWELLING	YES	-	-	22%	YES	-	-	22%
TWITCHING	YES	YES	-	28%	-	YES	-	18%
ITCHING	-	YES	-	18%	-	YES	-	18%
ENVIRONMENTAL CONDITIONS	HOT	MEDIUM	COLD	Accumulation Rate (%)	HOT	MEDIUM	COLD	Accumulation Rate (%)
It depends on the region or Patient environment	-	YES	YES	18%	-	-	YES	16%

4. Conclusion

In this assessment of venous hypertension as well as the system's being a safer option for preventing varicose veins is indeed a preventative health design, and for almost all

instances, they are unaware of any problem occurring inside the leg. It would be extremely beneficial to reduce the frequency of varicose veins. A proper hypertension assessment was necessary to prevent the problem from developing. The simplest way to get a correct answer for building this dataset is to use EMG assessment. That design

would be more useful in the future for several individuals who want to get treatment for varicose veins. Throughout this condition, patients may feel the corrections that reduce varicosity of the veins and stress. While chiropractic therapy improves blood circulation and reduces vein swelling, as well as the nutrition that follows, it helps to remove varicose veins and functions as a natural blood thinner.

References

- [1] Deepika Princess D., Mohan Jagannath and Biju Shalvin Y. J, "Ultrasound Therapy for Varicose Vein", International Research Journal of Medical Sciences, Vol. 1 (10), November (2013), no. 1, 22-25.
- [2] Gennady Victorovich Savrasov, Nikita Vladimirovich Belikov, Alexander Vasilyevich Gavrilenko, Irina VitalyevnaKhaydukova, Anna SergeevnaBorde, Irina Alexandrovna Seliverstova, AnastasiyaDmitrievnaSolntseva "Comparison of Mechanical Parameters of the Great Saphenous Vein under Various Test Conditions", IEEE AACCESS (2019), no. 2, 44-47.
- [3] Arun Kumar 2017 An survey of Low Power FFT Processor for Signal Procession Applications.
- [4] E Yaka 2015 Comparison of the Glasgow-Blatchford and AIMS65 Scoring Systems for Risk Stratification in upper Gastrointestinal Bleeding in the Emergency Department (Acad. Emerg. Med vol. 22, no. 1) pp. 22-30.
- [5] G. D. Parmar, Navdeepsingh V. Limbad "Vein Pattern Detection System Using Cost Effective Modified IR Sensitive Webcam", International Journal For Technolngical Research, Volume 1, issue 9, May 2014.
- [6] Manam Mansoor, Sravani S. N, Sumbul Zahra Naqvi, Imran Badshah, "Real Time Low Cost Infrared Vein Imaging System" International conference on signal processing and pattern, IEEE 2013.
- [7] Naomi Christianne Pereira, Jessica D'souza, Parth Rana, SupriyaSolaskar "Obesity Related Disease Prediction From Healthcare Communities Using Machine Learning", IEEE – 45670, July 6-8, 2019.
- [8] Chandramohan, Abinya; Sasi, Anju; Venkatesh, Suresh; Varicose vein controlling system using EMG signals Mohanarathinam, A. Journal of Physics: Conference Series; Bristol Vol. 1937, Iss. 1, (Jun 2021). DOI: 10.1088/1742-6596/1937/1/012046.
- [9] Ruizong Zhu, HuipingNiu, Ningning Yin, Tianjiao Wu, Yapei Zhao"Analysis of Varicose Veins of Lower Extremities Based on Vascular Endothelial Cell Inflammation Images and MultiScale Deep Learning", IEE ACCESS. 2019.2954708, Vol. 7, December 16, 2019.
- [10] S. Prasantamrongsiri "3D finite element analysis of varicose vein therapy by using microwave ablation" Biomedical Engineering international conference 2012.
- [11] Naragatti, Siddappa 2019 Case Study on Patient With Varicose Veins (International Journal of Current Advanced Research vol. 8).
- [12] Lim SY 2020 Catheter-directed foam sclerotherapy, an alternative to ultrasound-guided foam sclerotherapy for varicose vein treatment: A systematic review and meta-analysis, Phlebology.
- [13] M. Arun Kumar 2020 An Efficient Patient Health Monitoring System Using IOT For Health Care Applications (Waffen-Und Kostumkunde Journal vol. 11) pp. 219-222.
- [14] Thor Bechsgaard, Kristoffer Lindskov Hansen, Andreas Hjelm Brandt, Simon Holbek "Blood Flow Velocity in the Popliteal Vein using Transverse Oscillation Ultrasound ", Proc of SPIE Vol. 9790 979003-1.
- [15] M. Arun kumar 2020 Face Recognition System For Visually Impaired People (Journal od Critical Reviews vol 7) pp. 2760-2764.