Healing evaluation of varicose leg ulcers after injection sclerotherapy of pathological leg perforator veins

Original Article

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ABSTRACT

Background: According to the Scottish Guideline, a chronic venous leg ulcer is an open lesion that develops in the presence of venous illness between the knee and ankle joints and does not heal after at least four weeks. Venous leg ulcers (VLUs) make up 70% of all leg ulcers and are thought to affect 1% of the population, with an incidence that rises with age, according to a cross-sectional research done on a random sample in Edinburgh.

Aim: To evaluate the efficacy of injection sclerotherapy of incompetent perforators in the healing of VLUs.

Patients and Methods: This study was conducted on 50 patients with chronic VLUs that had been presented at least four weeks ago. To evaluate the clinical efficacy of Duplex-guided foam sclerotherapy with compression therapy in comparison with compression therapy alone, we divided the patients with randomization into two groups. Group A was conservatively managed by a four-layer compression bandage and group B was managed by the application of duplex-guided injection sclerotherapy and a four-layer compression bandage.

Results: Our research indicates a statistically significant positive association between the ulcer's duration, its surface area, and the amount of time it takes to heal completely. Only the ulcer surface area at the beginning of therapy was substantially connected with the period of full healing on linear regression analysis of covariates strongly correlated with it (β=1.031, $P<0.001$).

Conclusion: With just 45 min of work and no recovery period, patients undergoing duplex-guided sclerotherapy can return home from an outpatient clinic following a straightforward operation that requires neither hospitalization nor anesthesia. This is the first-line therapy for venous ulcers and is better than compression alone because of the relatively short healing time and clear results.

Key Words: Injection sclerotherapy, pathological leg perforator veins, varicose leg ulcers.

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INTRODUCTION

Venous ulcers are thought to be the most frequent cause of ulceration in the lower extremities and are one of the adverse effects of chronic venous insufficiency. About 80% of lower extremity ulcers are venous ulcers, which have a 1.2% general prevalence. Chronic venous insufficiency is linked to significant healthcare expenses and significantly affects a patient's health-related quality of life. Getting surgery is a somewhat intrusive procedure. After therapy, venous ulcer recurrence rates have been observed to range from 20 to 80%[1,2].

Techniques including foam sclerotherapy, radiofrequency ablation, and endovenous laser ablation have been applied to these patients more and more[3].

Foam sclerotherapy guided by duplex ultrasonography is a minimally invasive procedure that may be repeated as needed. It can also enhance both cosmetically and functionally and is less expensive. Because duplex-guided foam sclerotherapy eliminates the need for general anesthesia, hospital hospitalization, and protracted recovery periods, it has been deemed very appealing[4].

PATIENTS AND METHODS:

Study population

Participants in our study were patients (over the age of 18) who were seen at the outpatient clinic of the Vascular Surgery Department at the Nasser Institute for Research and Treatment and the Faculty of Medicine at Ain Shams University.

Inclusion criteria include:

(a) Patients age greater than 18 years.

(b) Venous ulcers with significant incompetent perforators

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(c) Able to understand and comply with the requirements of the trials.

(d) Patients with only isolated incompetent leg perforators with axial veins either already stripped, ablated, or even normal

(e) ABPI greater than 0.7

Exclusion Criteria Include:

(a) Patients with neuropathic, ischemic, pressure, and malignant ulcers.

(b) Patients refused to be included in the study.

(c) Recent deep vein thrombosis.

(d) Pregnancy.

(e) Known allergy to sclerosant material.

(f) ABPI less than 0.7

(g) Concurrent arterial disease.

(h) Ulcers that were found to have alternative etiology as basal cell carcinoma, Squamous cell carcinoma, or vasculitis.

(i) Patient with the incompetent axial vein (great saphenous vein and or short saphenous vein).

Study design

The study was a Randomized Control Trial, randomization was done by giving numbers to patients who complained of Venous leg ulcers (VLUs), a single number belonged to group A, and a binary number belonged to group B.

(a) Group A: treated with four-layer compression alone.

(b) Group B: treated with duplex-guided injection sclerotherapy four-layer compression.

Sample size: 25 patients per group

Study period: 3 years, between January 1, 2021 and January 1, 2024

Study procedures

History

(a) Demographic data including age, sex, smoking history, past medical history, and history of deep venous thrombosis.

(b) History of previous operations.

General assessment

(a) General physical examination of the patient

Local examination

Ulcer Assessment: The ulcer was assessed carefully (at the first visit and every 2 weeks) in the following aspects:

(a) Ulcer measurements were taken in greatest length and width then calculation of ulcer surface area according to this formula: Length × width ×0.7854 (an ellipse is closer to a wound shape than a square or rectangle that would be described by simple length ×width)[5].

(b) Assessment of lower limb edema and assessment of surrounding skin of ulcer for signs of inflammation, induration, and pigmentation.

(c) Ankle joint mobility assessment, mobility of the patient

(d) Detection of revised severity score system and CEAP classification score

Investigation

(a) All patients received an Ultrasound examination to assess the deep and superficial venous systems as regards occlusion and/or reflux, to assess incompetence of pathological perforators, and reflux of dermal/subdermal venous plexus.

(b) Full lab investigation.

Ulcer management protocol for group A patients

On the initial appointment, the ulcer was severely mocked and cleansed by rinsing with a saline solution to get rid of any exudate. The lesion was covered with sterile gauze and secured in place with a sterile roller bandage. At subsequent visits every 2 weeks, saline cleaning was used instead of debridement.

After 2 weeks, a four-layer bandaging technique (described below) was used as compression treatment.

Ulcer management protocol for group B patients

On the first visit, the ulcer was severely deformed and treated with saline irrigation to get rid of any exudate. In the operating room, incompetent perforators underwent duplex guided foam sclerotherapy in conjunction with compression therapy.

After the ulcer has healed (complete epithelization)

(a) The patient was recommended to utilize compression treatment, which involves a monthly follow-up at the outpatient clinic and a four-layer bandaging system breakdown.

(b) Additionally, an appointment is made if surgical measures to address CVI are indicated.

Compression therapy

Patients in both study groups received compression treatment using a four-layer bandaging device with an elastic layer and high compression (sub-bandage pressure of 35-40 mmHg). The methods and parts of this system, also known as Charing Cross Hospital Bandage, are in accordance with the International Leg Ulcer Advisory Board and SIGN standards (Scottish Intercollegiate Standards Network): (Figs. 1, 2).

Fig. 1: Component of four-layer bandaging[6]. 1. orthopedic cotton role 2. cotton crepe bandage 3. elastic extensible bandage 4. elastic cohesive bandage.

First layer: To protect the bony prominence and absorb exudate, an orthopedic cotton role is applied in a spiral pattern with minimal overlap from the base of the toes to just under the knee. In patients whose ankle circumference is less than 18 cm, an additional layer is required to artificially increase the circumference.

Second layer: (cotton crepe bandage), placed in a spiral pattern with 50% overlap, over-smooths the initial layer and has the final impact in compression.

Third layer: Applying an elastic extensible bandage in a figure-of-eight winding from the base of the toes to just below the knee with 50% extension results in subbandage pressure of 17 mmHg. The ankle joint is maintained at a 90° angle or in dorsiflexion.

Fourth layer: elastic cohesive bandage, it is 2nd layer of compression, applied in a spiral fashion with 50% overlap and 50% extension (adds remaining=23 mmHg sub bandage pressure).

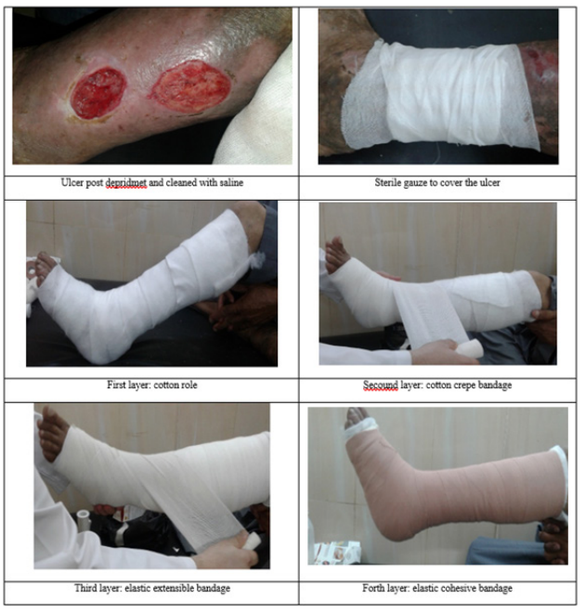

Fig. 2: Four-layer compression bandaging steps[6].

Preparation of foam sclerotherapy

Using two 5 ml syringes, a modified Tessari's technique was used to create sclerosant foam. One syringe holds 1 ml of ethyoxysclerol 2/3% and 4 ml of room air. Connecting syringes requires a three-way stopcock. After that, foam is created via cavitation, which requires an average of 20 back-and-forth travels between syringes. This kind of foam is stable for a duration of 1–2 min (Fig. 3).

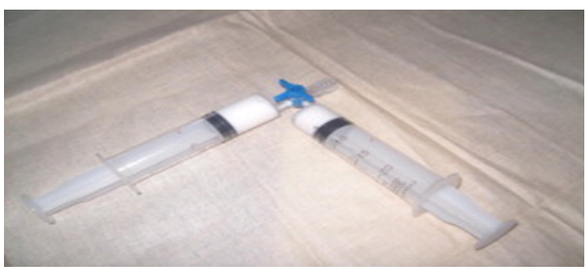

Fig. 3: Modified Tessari method.

Pre-treatment duplex ultrasound mapping

The way the exams were conducted was typical. Using a sensosite Micromaxx limited with a 10 MHZ transducer, patients were evaluated standing with their weight on the contralateral limb and the leg to be examined slightly bent with the heel on the floor to relax the calf muscle while preserving stability.

The proximal and distal superficial femoral vein, the popliteal vein above and below the knee, the saphenofemoral and sapheno-popliteal junctions, the whole length of the great saphenous vein, and the short saphenous vein were all insolated.

Every vein was checked for patency and compressibility. Reflux was defined as the reverse flow lasting more than 0.5 s and was caused by manually squeezing the calf. A perforating vein is deemed incompetent if the flow reversal (toward the superficial veins) lasts longer than 0.4 s, the vein's size at the fascial orifice is more than 3.5 mm, or both conditions are met. During the duplex scan, inadequate perforating veins were seen in the regions with ulcers and skin damage, in vein clusters associated with corona phlebectatica, and in areas with skin damage. This information is crucial for the development of the plan of sclerotherapy and for a decision on how to treat each of the incompetent perforators.

Patient positioning: In cases when the medial portion of the leg has inadequate perforator veins, the patient is positioned supine, with the treated leg raised 20–40 cm above the couch, the hip externally rotated, and the knee normally slightly bent to relax all muscle groups. With the foot supported by a cushion and the knee slightly bent, the patient is placed in the prone position for small saphenous and incompetent perforator veins on the posterior leg.

The technique of duplex-guided injection of foam

By using the foam injection technique guided by duplex ultrasonography, the treatment procedure aims to eliminate all incompetent superficial and perforator channels, preventing aberrant pressures and retrograde flow from the deep to the superficial venous system. The method is as follows:

(a) Target vein imaging using a longitudinal or transversal probe scan. Often a transducer at 10 MHz. To better control needle penetration and monitor foam distribution, the vein in the middle of the screen is a useful feature.

(b) Cleaning and disinfection of the selected area by alcohol 70%.

(c) Cannulation: The incompetent vein perforator is being cannulated using a 20 G 44 mm butterfly. The suction of nonpulsatile venous blood, ultrasound viewing of the needle tip, and lastly the injection of regular saline into the vein might all be used to confirm the proper insertion. Along the transducer's sagittal plane, the needle is put near the transducer tip. The tip of the needle should be visible with ultrasonography once it has penetrated the skin. An indentation will appear on the vein wall as soon as the needle tip contacts the target vein. Next, a little more pressure is applied to puncture the vein wall and reveal the tip within the lumen.

(d) To stop the sclerosing foam from spreading to the deep venous system, a 1/4 ml volume of foam is injected and compression using a digital or transducer is carried out. We occasionally employ the 5 ml saline injection around the perforator as part of the preinjection internal compression procedure.

(e) External compression using class II (25–35 mm/g) graded compression stockings after a week of creep bandage application.

(f) Postinjection guidelines: patients were instructed to walk nonstop for 15–20 min right after the procedure and then for at least 45 min every day for the next 2 days.

Follow-up and outcome measures: The resolution of the ulcer and total occlusion, or elimination of reflux, were the selected end measures. After their treatments, all patients were checked on three months later.

The bandages were taken off on the initial appointment, and a duplex test was run with a focus on DVT detection. During the subsequent follow-up appointments, we check for any problems, repeat the venous duplex test, and look for ulcer healing (Fig. 4).

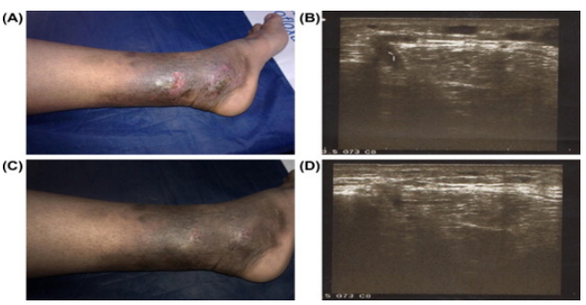

Fig. 4: (A) Venous ulcer before sclerotherapy. (B) Duplex of Perforator vein before sclerotherapy. (C) Venous ulcer after sclerotherapy and (D) Duplex of Perforator vein after sclerotherapy.

Statistical analysis

Statistical analysis was done by SPSS v26 (IBM Inc., Armonk, NY, USA). Shapiro–Wilks test and histograms were used to evaluate the normality of the distribution of data.

Quantitative parametric data were presented as mean and standard deviation (SD) and were analyzed by unpaired student t-test. Quantitative nonparametric data were presented as the median and interquartile range (IQR) and were analyzed by Mann–Whitney-test.

Qualitative data were presented as frequency and percentage (%) and were analyzed using the χ^2 test or Fisher's exact test when appropriate.

A two tailed *P value* less than or equal to 0.05 was considered statistically significant.

RESULTS:

25 patients with lower limb venous ulcers each group, split into two groups by control randomization, participated in the study, which was a Randomized Control Trial:

Group A: (just for compression) Following ulcer debridement, this group was conservatively handled with six sessions of irrigation with a saline solution and one weak gap in between. The four layers of compression bandage were used.

Group B: (Compression + Foam Injection) For six sessions spaced 1 week apart, this group was treated with foam sclerotherapy of incompetent perforators, followed by four layers of compression bandage following ulcer debridement and irrigation with saline solution.

Incompetent perforator pathology with normal or treated axial superficial and deep venous systems caused lower leg venous ulcers in 25 patients per group between January 1, 2021 and January 1, 2024. In group A, there were 20 (80%) male patients and five (20%) female patients. The patients in group A ranged in age from 28 to 53 years old, with a mean age of 42±7.8 years.

There were 14 (56%) girls and 11 (44%) men in group (B). The patients' ages ranged from 18 to 50 years old, with a mean age of 35.18±9.74 years.

Table 1 shows that there is a statistically nonsignificant difference in the demographic data between the groups under study.

Regarding characteristics of venous ulcers in compression group (A), venous ulcers were single in 80% of patients most of them at the left leg (60%) at the medial aspect of gaiter area (68%). There were 2.14±1.28 cm^2 for the surface area with a range of 0.5–5 cm^2.

In compression with perforator injection group (B), venous ulcers were single in 90% of patients most of them were at the left leg (52%) at the medial aspect of the gaiter area (88%). They were 4.07±2.33 for the surface area with a range of 1–8 cm^2.

Ulcer duration per week was 12–90 weeks with a mean of 33.82±25.23 in group (A), while in group (B) was 4–30 weeks with a mean of 12.64±9.99.

Regarding the length of ulcers in weeks, there is a statistically significant difference between the groups under study (with group A experiencing substantially longer ulcers). The ulcer's side, location, length, breadth, or surface area, however, do not change much among them.

There were 25 limbs in 25 patients in each group. All patients presented with active ulcers with CEAP C6, and venous clinical severity score ranges from 19 to 22 with group (A) and from 18 to 22 with group (B). ankle-brachial index was 1 in all cases. There were no statistically significant differences between the two groups as regards different scores, (Table 2 and Fig. 5).

Complete wound healing was achieved in group (A) of 20 (80%) patients with a duration time of 8–12 months. In group (B), complete wound healing was achieved in 23 (92%) patients with a duration time 4–8 months. There is a statistically significant difference between the studied groups regarding the time of wound healing which is shorter in group B, (Table 3).

Follow-up for all patients was done weekly for 6 weeks and subjected to careful clinical measurement of surface area which included length and width of ulcer and ultrasound assessment of perforator closure after injection in group (B).

Regarding the surface area of ulcers at the first, fourth, and fifth weeks, there is a nonsignificant statistical difference between the groups under study. (Table 4) indicates a noteworthy dissimilarity between them at the second, third, and sixth weeks.

During follow up there was no mortality or major complications. Minor problems like itching and infection appeared in a few cases in group (A) while group (B) did not have any major or minor problems. There is a statistically nonsignificant difference between the studied groups regarding adverse effects of treatment approaches, (Table 5).

Only the ulcer surface area at the beginning of therapy was substantially connected with the length of full healing on linear regression analysis of covariates strongly correlated with it (β=1.031, $P<0.001^{**}$). Increase the ulcer's surface area by 1 cm^2 at the beginning of therapy, and it will take approximately 1 week for it to heal, according to (Table 6).

Table 1: Comparison between the studied groups regarding demographic characteristics

	Compression group (A) *N* (%)	Combined compression and foam injection group (B) *N* (%)	Test of significance	*P*
Sex				
Male	20 (80)	11 (0.44)	Fisher	0.476
Female	5 (20)	14 (0.56)		

Age				
Mean±SD	42±7.8	35.18±9.74	t (1.812)	0.085
Range	28–53	18–50		
Hypertension	11 (44)	10 (40)	Fisher	0.235
Diabetes mellitus	8 (32)	7 (28)	Fisher	0.843
Smoking	9 (36)	9 (36)	Fisher	0.684

Fisher: fisher exact test t-independent sample t-test.

Table 2: Comparison between the studied groups regarding ulcer characteristics

	Compression group *N* (%)	Combined compression and foam injection group *N* (%)	Test	*P*
Site				
Left leg	15 (60.0)	13 (52.0)	Fisher	1
Right leg	10 (40.0)	12 (48.0)		
Side				
Lateral	8 (32.0)	3 (12.0)	Fisher	0.635
Medial	17 (68.0)	22 (88.0)		
Ulcer length (cm)				
Mean±SD	2.14±0.74	2.48±0.9	Z –1.498	0.134
Median	2	2.5		
Range	1–3	1–4		
Ulcer width (cm)				
Mean±SD	1.73±0.68	2.02±0.51	Z –1.01	0.313
Median	1.5	2		
Range	1–3.5	1.2–2.5		
Ulcer surface area (cm^2)				
Mean±SD	2.14±1.28	4.07±2.33	Z –1.961	0.05
Median	2.25	5		
Range	0.5–5	1–8		
Duration of ulcer (weeks)				
Mean±SD	33.82±25.23	12.64±9.99	Z –2.706	0.007*
Median	26	8		
Range	12–90	4–30		

Fisher: fisher exact test Z Mann–Whitney test.
**P* less than 0.05 is statistically significant.

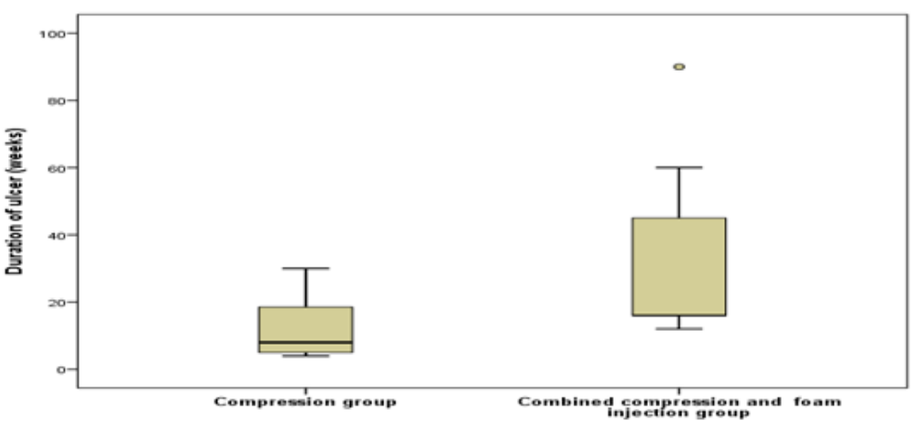

Fig. 5: Boxplot showing the duration of ulcers among the studied groups.

Table 3: Comparison between the studied groups regarding outcome of management approaches

	Compression group *N*=25 (%)	Combined compression and foam injection group *N*=25 (%)	X2	*P*
Outcome				
Nonhealing	5 (20.0)	2 (8.0)	Fisher	1
Complete healing	20 (80.0)	23 (92.0)		
	N=20	*N*=23	T	
Duration to complete healing				
Mean±SD	10±2.1	6.44±1.33	–4.333	<0.001**
Range (min – max)	8–12	4–8		

Fisher: fisher exact test t independent sample t-test.
**P less than or equal to 0.001 is statistically highly significant.

Table 4: Comparison between the studied groups regarding change in ulcer surface areas over time

	Compression group		Combined compression and foam injection group			
Ulcer surface area (cm^2)	Mean±SD	Median	Mean±SD	Median	Z	*P*
At 1st week	2.14±1.28	2.25	4.07±2.33	5	–1.961	0.05
At 2nd week	0.97±0.93	0.75	3.26±2.21	3	–2.28	0.023*
At 3rd week	0.51±0.72	0.13	1.94±1.45	1.5	–2.66	0.01*
At 4th week	0.5±0.72	0	1.36±1.15	1.5	–1.537	0.124
At 5th week	0.88±0.88	0.88	0.84±0.61	0.5	–0.280	0.780
At 6th week	0.63±0.53	0.63	0.06±0.18	0	–2.294	0.025*
p(Friedman test)	0.089		<0.001**			

*P less than 0.05 is statistically significant.
**P less than or equal to 0.001 is statistically highly significant Z Mann–Whitney test.

Table 5: Comparison between the studied groups regarding the adverse effect of the treatment approach

	Compression group *N* (%)	Combined compression and foam injection group *N* (%)	X^2	*P*
Side effects				
No	16 (64.0)	11 (100)	4.889	0.180
Infection	2 (8.0)	0		
Itching	4 (16.0)	0		
Oozing	3 (12.0)	0		

Table 6: Linear regression of variables correlated with duration of complete healing among the studied patients

	Unstandardized coefficient		Standardized coefficients			
	β	Standard error	B	t	*P*	95%CI
Ulcer surface area(cm^2) at start of treatment	1.031	0.197	0.785	5.228	<0.001**	3.92–6.77

**P less than or equal to 0.001 is a statistically highly significant CI confidence interval.

DISCUSSION

It is believed that perforator veins are the cause of venous reflux and recurrent venous disease. This information is based on cross-sectional studies where the function was examined at a one-time point without knowing the sequence of events. The volume in the perforating veins is small and reflux has been defined as the outward flow of greater than 350 MS but for simplicity has been accepted as greater than 0.5 s similar to the superficial veins. However, with time in patients having reflux more blood is going through the perforators to be drained in the deep veins. These perforator veins due to the higher volume of blood dilate over time to accommodate the need and at some point may become incompetent[7].

Reversing ambulatory venous hypertension, the primary pathogenic cause causing VLUs, is critical to managing VLUs. For venous ulcers, debridement

and local wound care are common procedures. Wound debridement can be accomplished in several ways, such as mechanical, chemical, or autolytic debridement[8].

Compression treatment, in conjunction with novel adjuvant therapies that supply the essential growth factors to facilitate the healing process, is the foundation of management[9]. Raffetto and Marston[10] discovered that the use of compression treatment speeds up the healing of venous ulcers compared with not using it, and that high-graded compression using three or four layers of bandage or short stretch bandage works better than alternative low-pressure delivery techniques. Based on different compression model types, the healing rate at 12–24 weeks is around 60–70%.

There have been suggestions that foam sclerotherapy may be more successful and less prone to problems since it uses less sclerosant to cover a larger surface area. Initially, limbs that had not responded to traditional treatment were treated with foam sclerotherapy. Then, as more people employed the technique, it became evident that patients should begin receiving treatment as soon as they were referred for it. This is the first-line treatment for venous ulcers due to its apparent efficacy, ease of use as compared with surgical intervention, and relative lack of major consequences[11].

Ultrasound-guided foam sclerotherapy (USGFS) has been the primary treatment for isolated incompetent perforators, reticular veins, and recurrent varicose veins after stripping, also in elderly patients unsuitable for surgery, in patients on anticoagulants, and in patients with VLUs. Sclerosing foam is produced by mixing liquid sclerosant with air. The foam is injected under ultrasound control to monitor its distribution because air bubbles reflect ultrasound and produce acoustic shadowing[12].

Neither study included duplex follow-up to assess residual or recurrent reflux and its relationship with ulcer healing. Therefore, our study was conducted on 50 patients with chronic VLUs that had been presented at least four weeks ago. To evaluate the clinical efficacy of Duplex-guided foam sclerotherapy with compression therapy in comparison with compression therapy alone, we divided the patients with randomization into two groups. Group A was conservatively managed by a four-layer compression bandage and Group B was managed by the application of duplex-guided injection sclerotherapy and a four-layer compression bandage.

The use of foam sclerotherapy guided by duplex ultrasonography for the injection of incompetent perforators to treat venous ulcers in 40 patients with ages ranging from 20 to 62 (mean age of 43.4 years) was assessed by Eweda and Zaytoun[13]. Before examination, patients' problems ranged in duration from 2 to 7 years, with a mean of 2 and half years. The time to heal determined from the date of the first UGFS treatment session was used to define healing and recurrence rates after UGFS. The ulcer healing date was used to determine the timing of recurrence. In the 40 patients included in this trial, five (12.5%) ulcers healed at 1, 3, and 6 months following therapy, 28 (70%) ulcers, and 38 (95%) ulcers, respectively, had healed completely, three (8%) ulcers had recurred during the follow-up period.

Regarding the length of ulcers in weeks, our study found a statistically significant difference between the groups under investigation (with the combined compression and injection group experiencing much fewer weeks of ulcers than the other groups). The ulcer's side, location, length, breadth, or surface area, however, do not change much among them.

Our research indicates a statistically significant positive association between the ulcer's duration, its surface area, and the amount of time it takes to heal completely. Only the ulcer surface area at the beginning of therapy was substantially connected with the period of full healing on linear regression analysis of covariates strongly correlated with it (β=1.031, *P<0.001*). A 1 cm increase in ulcer surface area at the beginning of therapy results in a 1-week healing period.

32 VLUs were split into 17 small-size ulcers less than or equal to 10 cm^2 (mean starting surface area 4.9 cm^2 S.D. 2.9 cm^2) and 15 big sizes greater than 10 cm^2 (mean initial surface area 27.9 cm^2 S.D. 18.2 cm^2) in the Pinto *et al*.[14] research. The study's mean initial surface area for group A was 4.75 cm^2 (S.D. 1.4 cm^2), while group B's mean initial surface area was 5.19 cm^2 (S.D. 2.4 cm^2). The study's inclusion criteria did not allow the largest ulcer diameter to exceed 10 cm, and the results were almost in line with those of Pinto *et al*.'s[14] study, which found that all cases in the small initial surface area group ($\leq$10 cm^2) fully healed but required a longer period to heal the mean time for all cases was 6.3 weeks. In the large initial surface area group 67% of cases completely healed in a mean duration of 12.6 weeks.

Regarding the surface area of ulcers at the first, fourth, and fifth weeks, there is a statistically nonsignificant difference between the analyzed groups in our investigation. The differences between them in the second, third, and sixth weeks are noteworthy. Examining how the ulcer surface area changed over time in both groups, it was found that the combination group's change was statistically significant whereas

the compression group's change was not statistically significant.

Regarding the negative impacts of treatment modalities, we found that there is a statistically nonsignificant difference between the groups under investigation. Regarding the groups under study, there is a statistically non-significant variation in how well they tolerate compression. To prevent data from being spread across the two groups, the highest proportion of combined groups were able to endure the study's gel foam infection criterion.

Regarding age and gender, there are statistically nonsignificant differences between the groups under investigation in our study. Additionally, the Pinto *et al*.[14] investigation did not reveal any significant changes between the groups or a clear significant relationship between the venous ulcer and other chronic complaints such as diabetes or hypertension.

The results of our study, which combined duplex UGFS with compression, seem to be better than those of Ghauri *et al*.[15], who only used compression and made no effort to treat the superficial venous reflux (recurrence: 36¼28% at 12 months, healing 68¼83% at 6 months). To maximize the benefits of foam sclerotherapy, compression is a crucial component of the therapy 26. The effectiveness and safety of sclerosant in macrofoam for the treatment of VLU were assessed by Cabrera *et al*.[16]. They presented a retrospective analysis of 116 consecutive patients who had 0.27–1% polidocanol CO_2 macrofoam treatment over 10 years for 151 ulcers with a median duration (range) of 62 months. They concluded that UIPM is a successful and well-tolerated outpatient technique for treating superficial and perforating valveless veins. The unique pharmacological form of sclerosant drugs has several benefits, including a significant increase in their action, a selective impact on the endothelium, visibility on ultrasound examination, predictability of the result, a high success rate, and a low frequency of regression.

In the Darvall and Bradbury[17] research, a prospective analysis was conducted on 27 consecutive patients (28 legs) with a median age of 69 years who were receiving foam sclerotherapy guided by ultrasonography in addition to compression for the treatment of venous ulcers. Before, throughout, and six months following therapy. Foam was utilized in a median volume of eight (range 2–14) ml. Following UGFS, 22 (79%), 27 (96%), and 27 (96%) chronic venous ulcers were healed at 1, 3, and 6 months. One patient passed away from carcinomatosis, and two (7%) of the ulcers had returned. The primary conclusion is as follows: only two of the 27 chronic venous ulcers (96%) that were treated with UGFS and compression later on healed after three months.

In their[18] study, Gamal *et al*. examined the use of UGFS in the management of chronic venous ulcer patients. Similar improvements in the VCSS were achieved by surgery and foam follow-up therapy methods. For both methods, the anatomical success rate was comparable.

CONCLUSION

An essential first step in the treatment of venous ulcers is compression therapy. By accelerating recovery for regular daily activities and reducing the duration of compression therapy, this synergistic strategy can enhance quality of life.

With just 45 min of work and no recovery period, patients undergoing duplex-guided sclerotherapy can return home from an outpatient clinic following a straightforward operation that requires neither hospitalization nor anesthesia. This is the first-line therapy for venous ulcers and is better than compression alone because of the relatively short healing time and clear results.

CONFLICT OF INTEREST

There are no conflicts of interest.

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