The effects of foam sclerotherapy on ulcer healing: a single-centre prospective study

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ABSTRACT

INTRODUCTION This prospective study of foam sclerotherapy for varicose veins aimed to determine the outcomes of treatment including ulcer healing and complication rates in our unit. Data were collected prospectively over a 10-year period and maintained on a database by our vascular sciences unit, which performed the planning and post-treatment venous duplex scans. Patients undergoing treatment due to venous ulceration were identified from this database. An initial cohort of patients underwent a follow-up scan and assessment at one year.

MATERIALS AND METHODS Patients were treated with foam sclerotherapy, in multiple sessions if required, to occlude all incompetent superficial veins greater than 3 mm in size. We used 3% sodium tetradecyl sulphate as our sclerosing agent, according to our departmental protocol, followed by a period of compression therapy. Patients underwent pre- and post-treatment scans to assess venous competence, the effects of treatment and any complications that arose.

RESULTS We identified 336 patients treated for clinical, aetiological, anatomical and pathophysiological stage 5/6 venous ulceration. At six weeks post-treatment, 21% had fully healed ulcers and a further 46.1% were clinically improving with no further venous incompetence. The remainder continued treatment. An initial cohort of 162 patients was assessed at one year and 77.1% ulcers remained healed. The remainder demonstrated some venous incompetence and ultimately 12.5% required further treatment. Our complication rates were similar to those quoted in published meta-analyses including a deep vein thrombosis rate of 1.16%.

CONCLUSIONS Foam sclerotherapy remains a useful treatment option for venous ulceration with a low morbidity rate.

KEYWORDS

Sclerotherapy – Varicose veins – Venous ulcer

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Introduction

Foam sclerotherapy is an established treatment for varicose veins and, in the UK, the National Institute for Health and Care Excellence has recommended it for use if the patient is not suitable for endothermal ablation.¹ The technique involves injecting a sclerosant under ultrasound guidance into the target vein, which causes scarring and occlusion of the vessel. It is low cost and, as a minimally invasive technique, is well tolerated by patients in the outpatient setting, making it an attractive treatment option.²

Foam sclerotherapy, together with endovenous laser and radiofrequency ablation for the treatment of superficial venous incompetence, have been compared with surgery in a Cochrane review.³ This review looked at 13 trials with 3081 patients and found that there was no difference in symptomatic recurrence rate between foam sclerotherapy and surgery and broadly similar quality of life outcomes

across all groups (although the studies were too heterogeneous to confirm this statistically).

An important indication for treatment of venous incompetence is venous ulceration. Multiple studies have shown that venous ulcers are associated with poorer quality of life and socioeconomic consequences in younger patients.^{4,5} In this study, we assessed the effectiveness of foam sclerotherapy in healing ulcers in our unit and the complication rates associated with it.

Materials and method

During most of the study period, surgery and foam sclerotherapy were the only interventions available beyond conservative management with compression. Endothermal treatment of veins was introduced in June 2014. The choice of intervention was down to individual consultants but most patients having foam sclerotherapy were under

consultants who managed most of their patients this way. Other consultants referred only their older frailer patients for foam sclerotherapy. Foam was used to ablate incompetence in the truncal veins and major tributaries measuring over 3 mm in diameter. Most patients had some compression treatment of variable duration prior to foam treatment.

All patients referred for the treatment following a clinic review by a vascular surgeon underwent a pre-procedure venous duplex scan by a vascular scientist to determine venous anatomy and competence of veins. On the day of treatment, patients were then positioned supine or prone, depending on the vein requiring treatment, and with some reverse Trendelenburg tilt on the table to engorge the veins. The target vein was cannulated with a needle under ultrasound guidance and the table then returned to a neutral position. Our foam protocol included up to five injections of 0.5 ml of 3% sodium tetradecyl sulphate (STS) foam made up to 2.5 ml of foam with air using the Tessari technique.⁶ The patients were then placed in full- or knee-length (depending on target vein) compression stockings, which they wore continuously for six days followed by a further two weeks of daytime wear. Patients had a routine follow-up scan at around six weeks, the primary purpose of which was to assess the need for further treatment determined by the presence of continuing venous incompetence. Clinical progress between scans was also recorded in the database. We performed multiple sessions until all incompetent superficial veins greater than 3 mm were obliterated. If both legs required treatment, we treated the most symptomatic side first until fully treated before progressing with the contralateral side. The patients undergoing foam sclerotherapy in the first year after its introduction were followed up at one year.

This study is based on prospective data for all patients who underwent foam sclerotherapy for ulcers in our unit. The data was collected by the vascular scientists who performed the pre and post treatment scans and checked for late complications.

Data collected included patient demographics, indications for treatment, number of sessions required, any initial and delayed complications, failure of treatment (i.e. unplanned progression to other treatment modality) and volume of foam used to treat.

Results

Patient demographics

In total, 336 patients with venous ulceration were treated over a 10-year period (patients underwent the first session between January 2005 and October 2015). This included 144 men and 192 women with a median age of 74 years (range 48–84 years).

Treatment sessions

Foam sclerotherapy was performed by two consultant vascular surgeons in our unit. Our figures showed that the average number of sessions of foam sclerotherapy required to complete treatment was 2.05. Looking at this in further

detail, 155 (46.1%) of 336 patients required more than one session of sclerotherapy to complete treatment, of whom 117 required further treatment to the ipsilateral leg (34.8%) and 41 to the contralateral leg, implying complete ablation in the more symptomatic side (Fig 1).

On average, a total of 6.9 ml of the foam solution (representing 1.38 ml of neat 3% STS) was used per session (range 2–30 ml to 0.4–6 ml of neat 3% STS). We identified that higher volumes of foam were used in some early cases before our departmental protocol was formalised.

Ulcer healing

Clinical outcomes were assessed at patients' follow-up scan six weeks post-treatment. From this scan, we were able to see that, of the 336 patients treated for venous ulceration, 73 had fully healed ulcers (21% of patients treated). A further 155 demonstrated sufficient clinical improvement with no significant residual superficial reflux and were discharged, giving a treatment rate of 67.8%. The remaining patients continued with foam sclerotherapy until the superficial reflux was ablated.

Analysis of one-year follow-up cohort

The first 154 patients were invited for a follow-up scan at one year after completing their treatment; 16 of this group were found to have died, 15 were lost to follow-up and 128 attended. Overall, the ulcer healing rate was 75.7% at one year (97 of 128 patients). Twelve (unhealed) patients were booked for a further follow up scan to assess progress, six patients required further foam therapy (4.7%) and ten required alternative treatment for their venous disease, including radiofrequency ablation and surgical management (7.8%), with three choosing not to undergo further treatment. This gives an overall recurrence rate of 12.5%. Comparing those who remained healed with those not healed, there was no significant difference in number of sessions required (healed 2.63 and non-healed 2.64; $P = 0.96$) or age (healed 72.0 years and non-healed 74.8 years; $P = 0.087$).

Complications

Regarding immediate complications of the treatment, the most commonly documented issue was extravasation 5.08% with other complications of note being a 1.16% technical failure rate (failure to cannulate or instil foam) and a 0.87% rate of visual disturbance, a well-recognised adverse effect of foam sclerotherapy.

Looking at complications detected at the follow-up scan, there was a 1.16% rate of deep vein thrombosis (DVT; $n = 8$). The majority represented above-knee DVTs, which were treated with anticoagulation, while two cases were below-knee DVTs, which were treated conservatively with follow-up scans to exclude extension above the knee. The more common complications seen at follow-up were skin pigmentation and phlebitis related to the injection site (Table 1). The medical complications section in Table 1 refer to three patients who suffered respectively from cellulitis post-injection requiring admission, a possible delayed allergic reaction 48 hours after treatment and a

persistent tachycardia following injection requiring admission (no significant cause found).

Discussion

This study included 336 patients undergoing foam sclerotherapy to treat venous ulceration. Other studies have looked into patients with clinical, aetiological, anatomical and pathophysiological (CEAP) grade 5 or 6 venous ulcers treated with foam sclerotherapy including O'Hare ($n = 18$),⁷ Darvall ($n = 27$),⁸ Pang ($n = 130$)⁹ and the ESCHAR group ($n = 200$).¹⁰ A large meta-analysis on foam sclerotherapy reviewed a total of 6856 patients, of whom only 103 were treated due to venous ulceration.¹¹ This makes our outcome data presented above one of the largest series reported in the literature on ulcer healing with foam sclerotherapy.

We report an initial healing rate of 21% complete ulcer healing within six weeks with a total of 67.8% showing signs of ulcer healing; 75.7% ulcers were healed at one year in our follow-up cohort, with 12.5% of recurrence requiring further treatment. These rates compare with ulcer healing of 81% at six months (with protocol of up to two sessions of foam sclerotherapy) in the Pang study and 71% at six months in the ESCHAR group study (a single session of foam sclerotherapy).

It is worth comparing our results with those of the recent Early Venous Reflux Ablation (EVRA) trial.¹⁴ This multicentre randomised trial compared early endovenous therapy with six months of compression therapy followed by delayed endovenous therapy if venous ulceration persisted. They demonstrated, in 450 patients, that early intervention was associated with faster ulcer healing and more time free from ulcers. Almost 50% of the patients were treated with foam sclerotherapy. Their ulcer healing rate at 24 weeks was 85.6% in the early intervention group, with 76.3% in the delayed group with between 11.4–16.5% ulcer

recurrence at one year, respectively. Of those undergoing repeat ultrasonography at 6 weeks, there was a 83.3% rate of venous occlusion.

In this important study, which further demonstrates the benefits of endovenous therapy for venous ulceration, a higher initial ulcer healing rate and venous ablation was demonstrated than in our series but a comparable rate of ulcer recurrence at one year. The potential differences between our results may be a reflection of the heterogeneous treatments, including endothermal ablation in the EVRA trial, which has been shown to have better venous ablation rates than foam sclerotherapy.^{15,16} Furthermore, many of our patients had undergone initial trial of compression therapy before considering sclerotherapy and so our results may be more comparable to the delayed treatment group.

Across the study our efficacy rates for abolition of superficial reflux and complication rates are similar to those in the meta-analysis by Jia *et al*, who collated 69 studies and identified a wide range of efficacy and complication rates.¹¹ They found a median 87% rate of vein occlusion (range 67.4–93.8%) with follow-up generally less than three years in the larger studies. There was an 8.1% (range 0.5–51.2%) risk of recurrence, with the highest recurrence rate in a study with 10-year follow-up. They also looked at the rate of complications and found median rates of less than 1% for venous thromboembolism complications, a visual disturbance rate of 1.4%, thrombophlebitis rate of 4.7% and pigmentation rate of 17.8%. A further meta-analysis by Rathburn *et al* found a 0.95% risk of venous thromboembolism, visual disturbance rate of 1.2%, skin pigmentation rate of 18% and thrombophlebitis rate of 11%.¹² They also reported an overall ulcer healing rate of 88% across 21 studies totalling 881 patients but did not specify the timescale for healing. While not specified in the meta-analyses, most studies involve one or two sessions of foam sclerotherapy, which would completely ablate

Table 1 An overview of immediate and delayed complications for all sclerotherapy sessions

Immediate complications	Total events (n)	Total sessions (%)
Extravasation	35	5.08
Pain	10	1.45
Technical failure	8	1.16
Headache/dizziness	7	1.02
Visual disturbance	6	0.87
Chest pain	4	0.58
Delayed complications		
Pigmentation	32	4.64
Phlebitis	46	6.67
Above popliteal DVT	6	0.87
Below popliteal DVT	2	0.29
Medical complications	3	0.43
DVT, deep vein thrombosis.		

superficial reflux in around two-thirds of patients with our protocol.

While our DVT rate is similar to those quoted in the literature, we reported mainly above-knee DVT that were treated with appropriate anticoagulation. This ratio is similar to that in work by Kulkarni *et al*, who also noted a rate of 1.5% where only one of their DVTs was below the knee.¹⁵

The issues with our study include incomplete follow-up of all ulcer patients at one year to assess healing status. While we did manage to invite almost half the patients for follow-up, ideally all would have been assessed to provide the true rate of healing and recurrence at one year. We also had a significant rate of non-attendance but this is partly due to 17 patients dying during the study period. This is a reflection of the acceptability and low morbidity of treatment, which allows it to be considered in most patients regardless of age or comorbidity.

By only assessing patients at six weeks before discharging them if they were showing clinical and sonographic improvement, our initial healing rate appears low. It was not possible to arrange further follow-up sessions because of issues with availability of clinic and scanning time in our unit. This also applies to our one-year cohort. However, we were able to ascertain in this group that we were achieving comparable rates of ulcer healing using our treatment protocol.

A further issue is the 6.2% rate of either foam extravasation or technical failure. This study documents the work of two consultant vascular surgeons from the inception of the service, so this rate will include complications associated with initial inexperience. When comparing patients who commenced treatment within the first five years compared with the second five years showed an improvement but not significantly so (first five years 6.69% and second five years 5.89% ($P = 0.6$)).

Conclusion

We have demonstrated that our protocol for foam sclerotherapy is an effective technique for the treatment of venous ulceration in patients not suitable for endothermal ablation.

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