Letters

RESEARCH LETTER

Pulmonary Gas Exchange After Foam Sclerotherapy

Foam sclerotherapy (FS) is a safe and effective procedure. Indeed, transient ischemic attacks and pulmonary complications are usually mild, although stroke and pulmonary embolism events have occasionally been reported.[1] It has been speculated that gas microemboli, passing through the heart, may reach the lungs or, through a right-to-left shunt, the cerebral arteries. However, no treatment modification could completely prevent the cephalic dissemination of air bubbles. In an analogy with decompression sickness, a venous gas microembolization should lead to some loss of gas exchange surface, with consequent gas exchange abnormalities and reduction in the transfer factor of the lung for carbon monoxide (TLCO). The aim of this proof-of-concept study was to verify whether TLCO worsens after FS treatment.

Methods | Eleven consecutive voluntary patients, scheduled to undergo FS for varicose veins, were enrolled in the study. The study was approved by the local ethics committee. Written informed consent was obtained from participants. Exclusion criteria were history of thromboembolism, mobility impairment, contraindications to compression, and pulmonary and/or heart disease. Respiratory function tests (RFTs) were performed after an overnight fast and 24 hours of being smoke free using a Baires Computerized System (Biomedin) as described elsewhere.[2] The following parameters were obtained and adjusted for hemoglobin concentration: TLCO, CO diffusion index (through the alveolus-capillary barrier), and KCO (ie, TLCO adjusted for alveolar volume). Foam sclerotherapy was performed mixing polidocanol, 1%, with physiological gas (70% CO_2, 30% O_2) to constitute the final volume of foam to inject. Nine and 2 patients had the great saphenous vein (GSV) and the small saphenous vein (SSV) treated, respectively. Procedures conformed to the European Consensus on Foam Sclerotherapy guidelines. The mean (SD) volume of injected foam was 6.00 (2.82) cm^3 in SSV and 6.25 (1.67) cm^3 in GSV.

The timetable of the study was as follows:

- General clinical assessment
- After 10 minutes, RFT (time 0, T0)
- After 10 minutes, sclerotherapy
- After 20 minutes, RFT (time 1, T1)
- After 7 days, RFT (time 2, T2)

Results from RFT at T0, T1, and T2 were compared using *t* test analyses.

Results | Patients (7 women and 4 men) had a mean (SD) age of 64 (12) years. None of the patients reported adverse events resulting from the FS. No statistically significant difference across study time points was reported for RFTs ($P > .05$ for all comparisons) (**Table**). To limit the risk of having obtained false-negative results, detectable alternative analyses were performed ($\alpha = .05$; $P = .80$).

Our study was powered to detect true differences of 0.57, 2.42, 4.16, 0.22, 1.54, 5.99, 8.05, and 0.46 at the TLCO (T1 − T0), TLCO% (T1 − T0), KCO (alveolar volume [AV]) (T1 − T0), KCO% (T1 − T0), TLCO (T2 − T0), TLCO% (T2 − T0), KCO (AV) (T2 − T0), and KCO% (T2 − T0), respectively. Because these values cannot be considered as clinically relevant, we may assume our results as likely to be truly negative.

Discussion | Lung bubble microembolism seems unlikely to complicate FS, at least if a CO_2/O_2-based mixture, which is less likely to cause an embolism than an air-based one, is used.[3,4] Although the onset of pulmonary embolism following FS is negligible, dry cough and chest tightness are frequently reported. Their pathogenesis might be related to endothelin-1,[5] involved in the mechanism of cough through modulation of the transient receptor potential vanilloid 1 (TRPV1), expressed by airway sensory nerves and involved in the genesis of cough.[6] It is possible that gas exchange modifications may occur in the case of major respiratory alterations. However, the TLCO parameter we adopted is highly sensitive even to clinically silent modifications. Neurological adverse effects of FS have been reported within a few minutes from the foam injection. Therefore, we might have underestimated some pulmonary effect owing to the time needed for the patient to dress and be transferred to the RFT examination.

Table. Pulmonary Function Indexes Gas Exchange at Baseline (T0), 20 Minutes (T1) and 1 Week (T2) After Foam Sclerotherapy and Mean (SD) Difference Between T1 – T0 and T2 – T0[a]

	T0	T1	T2	Δ T1 − T0	*P* Value	Δ T2 − T0	*P* Value
TLCO (AV), mL/min/mm Hg	17.95 (4.77)	18.23 (4.59)	17.99 (4.83)	0.27 (0.61)	.17	−0.39 (1.64)	.94
TLCO (AV), %	73.90 (14.69)	75.36 (13.85)	74.45 (16.68)	1.46 (2.58)	.09	−0.55 (6.39)	.78
KCO, measured	4.04 (1.41)	4.01 (1.34)	4.07 (1.76)	0.64 (4.43)	.64	0.00 (8.59)	>.99
KCO, %	70.27 (21.26)	69.64 (19.97)	70.27 (26.14)	0.32 (0.24)	.67	−0.03 (0.49)	.84

Abbreviations: AV, alveolar volume; KCO, TLCO adjusted for alveolar volume; TLCO, factor of the lung for carbon monoxide.

[a] Data are given as means (SDs).

Nevertheless, no sign or symptom was reported by our patients in this timeframe.

Conclusions | Bubble microembolism either is not a typical effect of FS or has only a minimal impact on gas exchanges. Other mechanisms may account for FS-related respiratory adverse effects.

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