

improvement in symptoms but sustained an increased complication rate. Patients with smaller vein size should not be denied intervention or coverage on the basis of size criteria.

Author Disclosures: **S. Bendix:** Nothing to disclose; **E. Peterson:** Nothing to disclose; **L. Kabbani:** Nothing to disclose; **M. Weaver:** Nothing to disclose; **J. Lin:** Nothing to disclose.

Unexpected Frequency and Clinical Significance of Nontarget Superficial and Deep Vein Occlusion After Foam-Form Sclerotherapy



Kirill Lobastov, Athena Vorontsova, Victor Barinov, Leonid Laberko. Department of General Surgery and Radiology, Pirogov Russian National Research Medical University

Objective: Ultrasound-guided foam-form sclerotherapy (UGFS) appears to be a safe procedure associated with a low number of clinically relevant venous thromboembolism events. However, the incidence and clinical relevance of silent occlusions of deep and superficial veins that were not a target for treatment have not been carefully studied. The aim of this study was to address this knowledge gap.

Methods: This retrospective analysis focused on the electronic medical records of patients treated with UGFS at a private clinic in Moscow between 2015 and 2017. In accordance with the internal protocol, all patients underwent serial duplex ultrasound (DUS) examination at 1 to 2 weeks and 1 month, 3 months, 6 months, and 12 months after UGFS with mandatory fixation of the results in the electronic medical record. Serial DUS was used to identify nontarget venous occlusion, recognized as incomplete compression of any deep or superficial vein not subjected to obliteration. The analysis included patients who underwent at least one DUS examination 1 to 2 weeks after UGFS.

Results: The analysis included data on 257 lower limbs of 196 patients with varicose veins: 139 women and 57 men (mean age, 44.2 ± 12.2 years) with the following Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) clinical class distribution: C2, 74.0%; C3, 20.0%; C4, 4.5%; and C5, 1.5%. UGFS was performed in addition to laser ablation of the great saphenous vein in 54.9%, small saphenous vein in 10.5%, perforating veins in 26.1%, Giacomini vein in 3.9%, or anterior accessory saphenous vein in 1.9%.

Nontarget venous occlusion was detected in 60 limbs (23.3%) and was symptomatic in only three cases (1.2%). The majority of occlusions were localized in the untreated great saphenous vein trunk ($n = 23$) or the calf muscle veins ($n = 15$). Specific drug treatment was prescribed for only two patients; 91%, 66%, 37%, and 11% of all limbs were followed-up at 1 month, 3 months, 6 months, and 12 months, respectively. There were no cases of thrombus progression or symptomatic pulmonary embolism. At 6 months, no occlusions persisted. Recurrence of varicose veins at 12 months was noted in 16 cases (6.2%) by DUS. There were no differences between limbs as a function of occlusions (10.0% vs 5.1%; $P = .218$).

Conclusions: The frequency of nontarget vein occlusion after UGFS revealed by serial DUS may be as high as 23.3%. These occlusions tend to resolve by 6 months and do not affect clinical outcomes.

Author Disclosures: **K. Lobastov:** Nothing to disclose; **A. Vorontsova:** Nothing to disclose; **V. Barinov:** Nothing to disclose; **L. Laberko:** Nothing to disclose.

Early Results of a Randomized Clinical Trial of Mechanochemical Ablation Versus Cyanoacrylate Adhesive for the Treatment of Varicose Veins



Amjad Belramman,¹ Roshan Bootun,¹ Tjun Yip Tang,² **Tristan R. A. Lane,¹** Alun H. Davies.¹ ¹Section of Vascular Surgery, Imperial College London; ²Singapore General Hospital

Objective: Endovenous thermal ablation techniques have become the first-line treatment of truncal veins. However, these techniques

use heat and have need of tumescent anesthesia, which are often associated with pain. To overcome these side effects, novel nonthermal techniques, such as mechanochemical ablation (MOCA) and cyanoacrylate embolization (CAE), have been developed; these do not require tumescence or use heat. This randomized controlled trial aimed to assess the degree of pain resulting from MOCA compared with CAE. We are herein reporting the early results of this randomized clinical trial.

Methods: Patients with saphenous vein incompetence were randomized to receive treatment with either MOCA or CAE. The primary end point is pain score immediately after completion of truncal ablation, measured by a 100-mm visual analog scale. The secondary end points include entire treatment pain scores, clinical scores, and quality of life scores. Additional assessments include ecchymosis scores, occlusion rates, and time to return to usual activities/work at 2 weeks. Patients are observed at 2 weeks, 3 months, 6 months, and 12 months.

Results: So far, 84 patients have been recruited (66% women; mean age, 56 years). The vein treated was the great saphenous vein in 86% of cases, and 51% of the cases were randomized to cyanoacrylate ablation. Both groups had similar baseline characteristics. Patients in both groups experienced similar maximum pain score by visual analog scale (CAE: median 24 mm [interquartile range [IQR], 9-45 mm]; MOCA: median, 23 mm [IQR 11-49 mm]; $P = .464$) and number scale (CAE: median, 3 [IQR, 1-5]; MOCA: median, 3 [IQR, 2-5]; $P = .333$). Average pain score was also similar between treatment groups. Eighty-three percent (70 patients) of the population attended the 2-week follow-up. Postprocedure ecchymosis score, recovery time, and clinical and quality of life scores were similar between groups.

Conclusions: The early results of this trial showed that pain score is comparable between CAE and MOCA endovenous ablation. The results also indicated similar improvement in quality of life, clinical improvement, and recovery time. Recruitment of patients is ongoing, and longer term follow-up data are currently being collected.

Author Disclosures: **A. Belramman:** Nothing to disclose; **R. Bootun:** Nothing to disclose; **T. Y. Tang:** Nothing to disclose; **T. R. A. Lane:** Nothing to disclose; **A. H. Davies:** Nothing to disclose.

Diagnosis of and Therapy for Vein Insufficiency in Children



Johann Chris Ragg, Interventional Phlebology, Angioclinic Vein Centers

Objective: Venous insufficiency of the lower extremities is usually considered to be a genetically determined, long-term acquired disease. Children have rarely been examined.

Methods: In an ongoing study, until May 2018, a total of 170 legs in 85 children of Angioclinic vein patients aged 6 to 18 years (38 male; 47 female) were examined with high-frequency ultrasound (Siemens X700 [Siemens Healthcare, Hoffman Estates, Ill]; Mindray M9, 14-16 MHz [Mindray, Mahwah, NJ]; Vevo MD, 16-32 MHz [SonoSite, Bothell, Wash]). Investigation time was limited to 15 minutes. In case of visible vein changes (protruding, more intense color, increased diameter), ultrasound started here. Otherwise, systematic screening of saphenous veins and medial perforators was performed.

Results: In 47 of 85 children (55.3%), relevant venous disease was found in 59 of 170 legs (34.7%), as follows: focal valvular defects of the great saphenous vein (GSV; 14/170 [8.2%]), segmental GSV reflux without varices (15/170 [8.8%]), segmental GSV reflux with varices (11/170 [6.5%]), GSV side branch reflux only (13/170 [7.6%]), total GSV reflux (3/170 [1.8%]), focal small saphenous vein valve lesion (2/170 [1.2%]), segmental small saphenous vein reflux (1/170 [0.6%]), and medial perforator reflux (none). In the subgroup of 6- to 8-year-old children, 9 of 30 legs (30.0%) already showed pathologic changes. Among the cases allowing diagnosis of lesion type ($n = 53$), unilateral commissural mismatch was the most frequent pattern (24/53 [45.3%]). Whereas some findings may be treated at a suitable age (14-18 years) with today's methods (side branches: microfoam; saphenous: thermal, MOCA, biomatrix foam), vein-saving methods are still missing for single-valve insufficiency and stages before clinical reflux.

Conclusions: The unexpected high incidence of detected valve lesions in children, in particular the younger ones, should be best explained by congenital disease. It is a merit of today's ultrasound systems that these lesions now can be detected. New strategies for systematic early detection, coaching, and cost-effective therapy now have to be developed.

Author Disclosures: J. C. Ragg: Nothing to disclose.

Clinical Effectiveness of Mechanochemical Ablation Versus Radiofrequency Ablation for Symptomatic Great or Small Saphenous Vein Reflux



Aditya Gupta, Eddie Fernandez, Sanjiv Lakhanpal, Peter Pappas, Center For Vein Restoration

Objective: Mechanochemical ablation (MOCA) is a nonthermal technology approved by the Food and Drug Administration for the delivery of sclerosing agents to treat symptomatic saphenous vein reflux. Although the technology is considered durable, its effectiveness compared with radiofrequency ablation (RFA) in the great saphenous vein (GSV) and small saphenous vein (SSV) is ill defined.

Methods: Data were prospectively collected in the Center for Vein Restoration's electronic medical record system (NexGen Healthcare Information System, Irvine, Calif) and retrospectively analyzed. Patients were divided into the following treatment categories and stratified by Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) class: MOCA GSV, MOCA SSV, RFA GSV, and RFA SSV. The revised Venous Clinical Severity Score (rVCSS) was used to determine chronic venous disease treatment effectiveness in patients who underwent RFA and MOCA only in the GSV or SSV distributions. Patients with multiple treatment modalities were excluded from the analysis. In addition, the 20-item Chronic Venous Insufficiency Questionnaire (CIVIQ-20) was used to assess quality of life before and after intervention at 1 month. All statistical analyses were performed using GraphPad Prism 7 (GraphPad Software Inc, La Jolla, Calif). Treatment outcomes were assessed using unpaired *t*-tests and two-way analysis of variance.

Results: From January 2015 to December 2017, there were 21,383 patients (34,014 limbs) who underwent thermal or MOCA procedures for chronic venous disease. The average age of the cohort was 57.1 ± 14.04 years, and 73% were female. Patients/limbs were divided into the following groups: MOCA GSV (342/545), MOCA SSV (41/62), RFA GSV (15,069/25,153), and RFA SSV (1450/2087). Preintervention and post-intervention rVCSS and CIVIQ-20 data were analyzed at 1 month. All postintervention rVCSS outcomes for RFA in the GSV or SSV demonstrated significant improvement compared with preintervention scores regardless of CEAP class ($P \leq .001$). Patients treated with MOCA demonstrated improvement in all CEAP classes except for C5 MOCA GSV patients and C6 MOCA SSV patients ($P \leq .001$). CIVIQ-20 scores at 1 month were similar regardless of treatment modality or treatment outcome. CIVIQ-20 scores ranged from 50 before intervention to 35 after intervention at 1 month.

Conclusions: MOCA appears to be as effective as RFA in the GSV across CEAP classes. By rVCSS, MOCA may not be as effective as RFA in patients with C5 and C6 disease in the GSV and SSV distribution, respectively. However, patient-reported outcomes between treatment modalities are similar. MOCA in the SSV appears safe. Further assessment and long-term data are required.

Author Disclosures: A. Gupta: Nothing to disclose; E. Fernandez: Nothing to disclose; S. Lakhanpal: Nothing to disclose; P. Pappas: Nothing to disclose.

Explanted Saphenous Vein Histopathology 5.5 Years After Cyanoacrylate Closure: A Case Study



Jose Almeida,^{1,2} Stephen Murray³, ¹Vascular Surgery, Miami, Vein; ²Division of Vascular and Endovascular Surgery, University of Miami Miller School of Medicine; ³Vascular Surgery, Providence Vascular Institute

Objective: VenaSeal (Medtronic, Dublin, Ireland) cyanoacrylate closure (CAC) requires implantation of a device, not a drug. This case report describes the histopathologic features of an explanted segment of a great

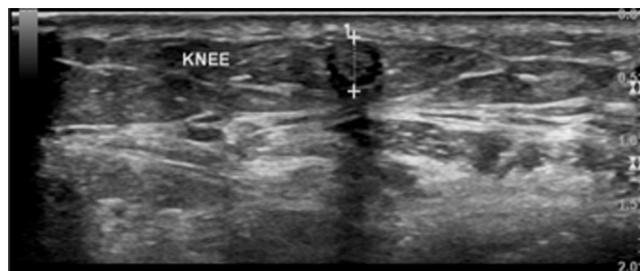


Fig 1. Ultrasound demonstrated echo-dense vessel with no venous flow.

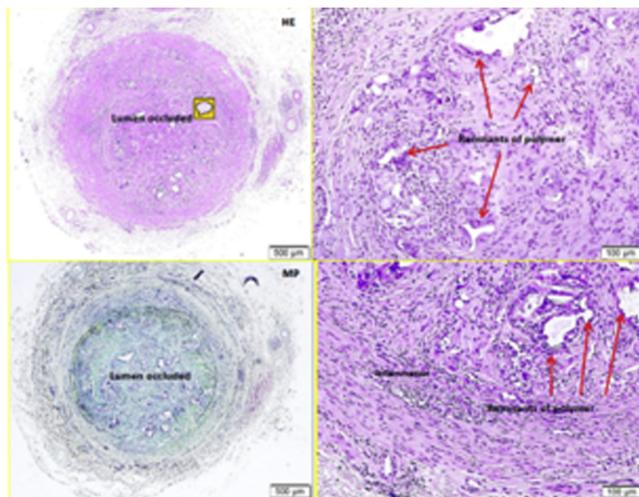


Fig 2. Microscopic and histopathologic examinations of the explanted saphenous vein.

saphenous vein (GSV) treated 5.5 years previously with CAC and compares it with an untreated control segment.

Methods: A segment of left GSV from a 65-year-old man 5.5 years after CAC was localized with duplex ultrasound and surgically excised at mid-thigh. An untreated control segment was excised from midcalf.

Results: The vessel was nonpalpable. Ultrasound demonstrated echo-dense vessel with no venous flow (Fig 1). On microscopic examination, the segments demonstrated a lumen filled by collagenized mature fibrous tissue and remnants of polymer material (Fig 2). Histopathology examination revealed cyanoacrylate encapsulated by multinucleated giant cells and chronic granulomatous inflammation within the vein wall and focally extending to the adventitial layer (Fig 2). The control vein exhibited thickening of the medial wall consistent with chronic reflux pathophysiology.

Conclusions: These findings demonstrate the presence of cyanoacrylate implant in a GSV treated 5.5 years earlier. The cyanoacrylate is intermittently dispersed throughout the vein as well as encapsulated by multinucleated giant cells and chronic granulomatous inflammation.

Author Disclosures: J. Almeida: Nothing to disclose; S. Murray: Nothing to disclose.

Contemporary Trends in the Treatment Types and Costs of Lower Extremity Superficial Venous Disease



Nathan Itoga, Elizabeth George, Celine Deslarzes-Dubuis, Kara Rothenberg, John Harris, Surgery, Stanford University

Objective: The treatment of lower extremity superficial venous disease has evolved from purely open procedures to less invasive procedures with