Endovenous therapies have become the recommended standard of care for the management of symptomatic great saphenous vein (GSV) reflux. Cyanoacrylate embolization (CAE) has emerged as a minimally invasive method of treating GSV incompetence that has demonstrated satisfactory safety and efficacy profiles in multiple randomized trials. Distinct from established thermal ablation therapies such as radiofrequency ablation and endovenous laser ablation, CAE does not require perivascular tumescent anesthesia or carry the risk of heat-associated complications to achieve similar rates of anatomic closure and symptom improvement.

The reported adverse events after CAE have been infrequent, mild, and self-limiting. The most commonly reported complication has been phlebitis (range, 5%-20%). Hyperpigmentation, access site infection, and hematoma are rare. Access site infection with underlying abscess formation has been reported early after treatment. Recurrent infection and infection requiring surgical excision of the treated vein have not been previously reported. We have reported a case of infective thrombophlebitis occurring 13 months after CAE. Our patient provided written informed consent for the report of his case.

CASE REPORT

The patient had presented with a history of bilateral lower limb chronic venous insufficiency. The 45-year-old man had a medical history that included Klinefelter syndrome, diabetes mellitus, and previous pacemaker placement for bradycardia. His medications included aspirin and dabigatran for previous cardiac mural thrombus. His left leg was more severely affected in the setting of May-Thurner syndrome and post-thrombotic syndrome secondary to a deep vein thrombosis 9 years prior to presentation. The left common iliac and external iliac veins had been treated with stents in 2015. In 2018, he demonstrated clinical features of progressive venous insufficiency involving the left leg that was characterized by hemosiderosis, lipodermatosclerosis, and varicose veins (CEAP [clinical, etiologic, anatomic, pathophysiologic] clinical class 4). Left lower limb duplex ultrasound demonstrated GSV incompetence in the upper thigh and small saphenous vein incompetence in the lower calf. Examination of the deep system revealed femoral and popliteal vein incompetence and a partially occlusive thrombus extending from the profunda femoris vein to the common femoral vein that proximally involved the stent ostium. The stent was patent. Subsequent computed tomography angiography revealed that the thrombus had completely resolved, although its etiology remained unclear after hematology review and screening for thrombophilia.

The left GSV was subsequently ablated using the VenaSeal Closure System (Medtronic, Minneapolis, Minn). The entire GSV was treated in accordance with the manufacturer’s instructions for use. Dabigatran was continued, and no postprocedural hematoma or other complications developed. Postprocedural duplex ultrasound confirmed successful ablation of the GSV and anterior accessory saphenous vein.

At 13 months after CAE, the patient developed a localized infection and abscess over the left calf at the puncture site. The infection
was managed with intravenous flucloxacillin, surgical incision, and drainage. An indurated sinus at the puncture site was excised and sent for microbial culture, which yielded no growth. He recovered well and was discharged with oral flucloxacillin.

The patient presented again 1 month later with a recurrent abscess proximal to the puncture site with associated cellulitis and phlebitis (Fig 1). On examination, tenderness was elicited along the palpable GSV cord from the calf to mid-thigh. No signs of systemic compromise were present. Intravenous flucloxacillin was recommended. Duplex ultrasound demonstrated a compressible GSV in the proximal thigh, which was noncompressible from the mid-thigh to the knee. In the calf, the abscess and surrounding GSV could not be imaged owing to the patient's discomfort.

The patient subsequently underwent ligation and excision of the GSV (Fig 2). Intraoperative examination of the abscess demonstrated fibrosed subcutaneous tissue that was adherent and a firm, enlarged segment of the GSV with purulent exudate. The CAE access site of the previous surgical incision demonstrated fibrotic inflammatory changes and was excised and left open to drain and heal via secondary intention. The GSV was sent in segments for histopathologic examination and bacterial, fungal, and mycobacterial culture. The bacterial culture yielded growth of *Citrobacter koseri* in the samples from the calf and proximal thigh. After consultation with the infectious diseases team, the patient was transitioned to oral cephalexin for a total of 2 weeks. No mycobacterial or fungal growth resulted from culture of the intraoperative specimen. Histopathologic examination of all segments of the excised vein demonstrated similar morphologic features, including widespread thrombophlebitis, segmental occlusion by foreign body embolic material with associated organizing thrombus, and a foreign body-type granulomatous reaction. The blood vessel wall demonstrated intimal and medial fibroplasia with a superimposed florid lymphocytic infiltrate, which extended into the adventitial fibroadipose tissue. The postoperative recovery was uncomplicated, and the surgical wound was well healed at the outpatient follow-up examination.

**DISCUSSION**

The safety of CAE has been established in multiple trials. After the early postoperative period, infection related to CAE has not previously been reported in studies with 36 months of follow-up. Phlebitis and erythema have been reported as late complications; however, these have not been specifically attributed to infection in the studies appraised.

Access site infection is uncommon after CAE. The VeClose (VenaSeal Saphenous Closure System vs Radiofrequency Ablation for Incompetent Great Saphenous Veins), WAVES (Lake Washington Vascular VenaSeal Post-Market Evaluation), and eSCOPE (European Saphenous Closure System Observational Prospective) trials were the first to evaluate the safety and efficacy of CAE for the management of symptomatic saphenous reflux. The most common adverse event in all three trials was phlebitis of the treatment zone (5%-20%). All cases were managed conservatively, and no procedure-related serious adverse events were reported in any of the studies (follow-up, 12-60 months). In the eSCOPE study, localized infection at the access point was identified in 1.4% of patients, and this rate has been replicated consistently in reported studies.

Some controversy surrounds the etiology of access site infections. They might be technique related. Yang et al postulated that access site infections might be secondary to a retained adhesive clump that serves as an infective nidus in the subcutaneous tissue after removal of the delivery catheter. Our patient did develop an initial abscess at the puncture site. The etiology for this case is
not clear. However, the postulation by Yang et al9 might explain our patient’s presentation.

Cyanoacrylate is a commonly used tissue adhesive with broad medical applications, including closure of enteric fistulas, treatment of endoleaks, embolization of arteriovenous malformations, and surgical incision closure. Severe cutaneous hypersensitivity reactions have been reported2; however, infection has rarely been described. Machin et al25 reported a review of the use of cyanoacrylate as an antimicrobial barrier to prevent postoperative wound infections, with no differences observed. The Venaseal adhesive is an N-butyl-2-cyanoacrylate liquid. Within the vessel, it solidifies and induces a granulomatous foreign body reaction, leading to fibrotic occlusion of the lumen. These changes were consistent with the histopathologic findings of the excised vein in our patient. C. koseri is a gram-negative bacillus, and infection almost exclusively occurs among hospitalized and institutionalized patients.25 It is possible that the chronic ulcer at the access site became infected and that during the subsequent hospital admission, the patient became colonized with C. koseri, which is resistant to the empirical antibiotic therapy used for skin organisms.

Intervention after CAE is generally performed to treat varicose tributaries, using adjunctive agents such as sclerotherapy or phlebectomy.2,24 Although localized puncture site abscess requiring incision and drainage has been reported, our case differs because the onset of the infection was 13 months after intervention and recurred despite initial treatment with surgical incision and drainage. The use of CAE has increased in interest because it is minimally invasive and cost-effective. Although isolated, the findings from the present case have demonstrated the potential morbidity associated with this generally safe and well-tolerated procedure. Clinicians should be aware of these potential complications to facilitate the informed consent process when considering the management of symptomatic saphenous reflux.

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Submitted Feb 22, 2021; accepted May 18, 2021.