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## EFFECTIVE MANAGEMENT OF LOWER LIMB PHLEGMON: DOPPLER-GUIDED VENOUS CYANOACRYLATE CLOSURE

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**Abstract:** Superficial venous insufficiency is a medical condition that can have a direct and significant impact on the appearance of redness, swelling, pain, and the development of sores and ulcers on the skin, which in some cases can progress to the development of phlegmon of the lower limb. This case report illustrates the effective management of severe lower limb phlegmon resulting from inadequate and enlarged superficial veins. The condition was successfully treated through noninvasive intravenous cyanoacrylate closure, guided by Doppler imaging, addressing the entire length of the great and small saphenous veins. A 36-year-old patient presented with severe phlegmon in the left leg for 2 years, accompanied by marked swelling, erythema, purulent ulcerative wounds, localized tenderness, and non-healing gangrenous wound on the second toe. Peripheral Doppler examination revealed an absent great saphenous vein in the femoral region (due to previous vein stripping) and a dilated great saphenous vein in the distal femoral and crural regions, along with multiple dilated perforator vein branches and a small saphenous vein with a dilated perforator vein that communicates with the great vein in the crural region. A swab was taken from the patient's wound, and it was proven that *Staphylococcus hemolyticus* was present. The patient was hospitalized and treated appropriately to reduce infection. Seven days after admission, the patient underwent Doppler-guided cyanoacrylate closure of the great saphenous vein in the left leg, followed by cyanoacrylate closure of the small saphenous vein nine days later. After two weeks, the patient exhibited significant clinical improvement, including pain relief, reduced lower leg swelling, diminished erythema, and complete wound healing of the second toe. This case illustrates the importance of timely diagnosis of superficial venous insufficiency and the success of treating the complications of the disease through modern noninvasive treatment.

**Keywords:** chronic vein insufficiency, phlegmon, venous cyanoacrylate closure

### 1. INTRODUCTION

Chronic venous disease is frequently encountered by healthcare professionals in Western Europe and the United States. Well-known risk factors include advancing age, being female, pregnancy, a familial predisposition to venous issues, obesity, and engaging in professions that involve prolonged standing. However, various lesser-documented factors such as dietary habits, levels of physical activity, and the use of external hormones could play significant roles in the onset and presentation of chronic venous disease. [1] Approximately 30% of women experience varicose veins in the trunk region. Although men generally have a lower prevalence, recent studies indicate that the prevalence among men may be approaching that of women, according to some surveys. [2]. Chronic venous disease (CVD) is a prevalent disorder that affects the circulatory system, representing a considerable health challenge for individuals and imposing a significant strain on healthcare infrastructures. This condition encompasses various physiological issues stemming from increased pressure in the veins of the lower extremities, with a range of potential triggers. Often, inadequate or malfunctioning venous valves leading to venous reflux are a key contributor to venous hypertension, causing reduced blood flow back to the heart, accumulation of blood, and subsequent occurrences of oxygen deprivation and inflammation. [1,2]. The manifestations of CVD in the legs exhibit variability and encompass telangiectasia (spider veins), varicose veins, edema, and alterations in skin appearance, such as eczema, hyperpigmentation, and induration. In advanced stages, skin or venous ulceration may also manifest. Symptoms range in severity and presentation, including discomfort such as pain, swelling, heaviness, cramps, and burning sensations, all of which can significantly disrupt daily life and result in absenteeism from work. Diagnosing CVD can be difficult because of its similarity to other dermatological conditions and insufficient recognition by medical professionals. Treatment for stasis dermatitis primarily focuses on compression therapy to

alleviate pain and swelling, topical remedies to address secondary skin changes, and interventional procedures targeting the root causes of venous reflux. [3,4] For many years, the conventional approach to treating varicose veins involved open surgery, which included tying off and removing the saphenous vein and excising large varicose veins. However, endovenous thermal radiofrequency ablation (RFA) and endovenous laser ablation have emerged as safe and efficient alternatives, boasting high rates of long-term closure of target veins. Although these methods have garnered widespread acceptance in various nations, a significant drawback is the need for tumescent anesthesia to prevent thermal damage to the surrounding tissues. [5] To address patient discomfort and minimize side effects associated with endovenous thermal ablation (EVTA), two novel methods, mechanochemical ablation (MOCHA) and cyanoacrylate ablation (NBCA), were introduced to the market. Eekeren et al. documented their findings over 1 year in 92 patients and 106 limbs, revealing occlusion rates of the great saphenous vein (GSV) at 93.2% after six months and 88.2% at the 1-year mark [6] In other studies, occlusion rates ranging from 1 to 6 months exceeding 90% have been recorded [7,8]. Almeida et al. and Bozkurt et al. showcased the secure and effective application of cyanoacrylate adhesive in addressing saphenous vein incompetence. [9] We present a case report to illustrate the successful resolution of severe lower limb phlegmon caused by insufficient and dilated superficial veins. The purpose of presenting this case report is to show that such cases, which are very often neglected and remain untreated for many years, can be successfully cured and prevent worse complications by treating the dilated and incompetent superficial veins with cyanoacrylate venous closure, which we consider to be the most reliable method in such cases.

## 2. MATERIALS AND METHODS

A 36-year-old man presented for examination with pronounced phlegmon and swelling on the left lower leg, which was painful on palpation, and a wound on the second toe of the left foot. The patient had no past illnesses or comorbidities and was not receiving any therapy for his condition. The patient informed us that a few years ago, he had undergone surgical intervention on the large superficial vein of the left leg (stripping). The patient underwent a peripheral Doppler examination of the left leg, which showed an absent great saphenous vein in the femoral region due to stripping, and a dilated great saphenous vein with measured dimensions of 8.5x8.5 mm in the distal part of the femoral region. In the crural region, a large dilated great saphenous vein 8.5x8.5 mm was measured, from which emerge perforator veins that are connected to each other and make direct communication with the femoro-saphenous junction and also make a natural bypass of the surgically extracted great saphenous vein. The small saphenous vein was also dilated and measured using a Doppler of 9 mm. The femoral and popliteal veins were properly compressible, and the femoro-saphenous and popliteal junctions were patent. The patient was hospitalized to heal the inflammatory process. A swab was taken from the wound on the left leg, which showed *Streptococcus haemolyticus*. The patient received therapy for the infection according to an antibiogram, namely intravenous vancomycin for two weeks. One week after hospitalization, the patient underwent Doppler guided cyanoacrylate closure of the great saphenous vein of the left leg, which was performed on an outpatient basis. In a 10-ml syringe, 4 ml of cyanoacrylate was applied into the venous system, and compression was made along the entire length of the great saphenous vein for 60s during the application. After compression, a Doppler of the great saphenous vein was performed, where an occluded great saphenous vein along the entire length of the femoral and crural region and collapsed perforator veins connected to the femoro-saphenous junction were noted. After the intervention, the patient received intravenous antibiotic and symptomatic therapy consisting of gentamicin, urbazone and ketonal. Two hours after the intervention, the patient felt relief of symptoms, reduction of pain in the leg, and absence of pain on palpation. The patient did not require compression stockings.

## 3. RESULTS

The patient was discharged for home treatment, and after 9 days, clinical examination showed significantly reduced swelling, inflammatory reaction, and pain on palpation. In the second act, the patient underwent Doppler guided cyanoacrylate closure of the small saphenous vein on the left leg, in the same way, by applying 3 ml of the cyanoacrylate. After the intervention, a Doppler scan was performed, which showed an occluded small saphenous vein along the entire length of the femoral and crural region. At the end of the intervention, the femorosaphenous junction and compressible femoral vein are properly monitored using Doppler. The patient received the same therapy as that used after the first intervention. The patient was advised to walk for 30 min a day several times. After 14 days, the patient subjectively and objectively did not complain of any pain, there was no heaviness in the legs, the swelling was completely reduced and the inflammatory process was repaired, the redness of the skin was reduced, the wound on the finger was healed, and no new wounds appeared.

*Picture 1. Before intervention*



*Picture 2. After intervention*



#### **4. DISCUSSION**

The contemporary approach to managing truncal venous insufficiency should satisfy the preferences of both patients and their physicians. The ideal method should be swift, minimally invasive, causing minimal discomfort or acceptable discomfort only, and highly efficient. It should ideally be suitable for outpatient settings and feasible without the need for advanced equipment. The endovenous cyanoacrylate vein closure procedure appears to meet most, if not all, of these expectations. It can be conducted in ambulatory settings without requiring hospitalization. With rare exceptions, it is nearly painless and typically necessitates only local anesthesia at the catheter insertion site. Because there is no need for the use of time-consuming tumescent anesthesia, the duration of this procedure depends mainly on the time required for vein access and precise placement of the catheter tip. [10] While thermal ablation methods yield acceptable outcomes, the need for tumescent anesthesia, post-treatment compression stockings, and potential side effects such as bruising along the great saphenous vein (GSV), paresthesia, arteriovenous fistula, pseudoaneurysm formation, and other adverse effects can lead to significant discomfort for patients. NBCA has been used for endovenous applications since 2000, particularly for treating arteriovenous malformations (AVMs) and peptic varicosities. [15,16] Collectively, these studies suggest positive outcomes for the treatment of incompetent GSVs using various techniques. The embolization system using cyanoacrylate showcased both short-term safety and effectiveness, notably enhancing the quality of life of a diverse group of Asian patients from Singapore. A retrospective study comparing radiofrequency ablation (RFA) with n-butyl-cyanoacrylate embolization (CAE) suggested that CAE matches the effectiveness of RFA, potentially presenting benefits such as decreased pain and fewer complications. [13] In addition, the prospective comparative study of cyanoacrylate glue versus endovenous laser ablation underscores the safety and simplicity of cyanoacrylate ablation, which features shorter operative times and less procedural pain than endovenous laser ablation. [14] In the absence of longer-term follow-up data, these findings collectively suggest that cyanoacrylate-based techniques, including Venablock and cyanoacrylate ablation, are effective and safe options for treating incompetent GSVs. Additionally, the studies collectively reported significant improvements in the Venous Clinical Severity Score (VCSS) and Aberdeen varicose vein questionnaire (AVVQ) scores postoperatively, with statistically significant differences observed ( $p < 0.0001$ ) between pre-operative and 6th-month scores. [12] Rigorous, extended trials with larger cohorts are essential

for validating the durability and comparative effectiveness of these interventions. In the last 9 months in our Vein Treatment Center, over 150 cases have been treated in patients with incompetent large and small saphenous veins, where the percentage of successful closure is over 95%. Due to huge dilated veins over 25 mm in 5 cases, there was a need for re-intervention of fragments. In this patient, due to the chronicity of his condition and the lack of treatment for years, a complication occurred that could further lead to the formation of venous ulcers that are much more difficult to treat. In the first step, it was necessary to stabilize the inflammatory process with antibiotic therapy and later to treat the dilated insufficiency veins to prevent further complications. The most suitable option for him was the option of treating the veins with cyanoacrylate closure because of its inflammatory nature, which does not allow it to be treated quickly surgically or with thermal ablation. With this procedure, the veins are closed, i.e., occluded along their entire length, which allows blood to return through other healthy veins. After the first intervention on the great saphenous vein, the patient experienced a reduction in the symptoms and redness of the leg. After the second intervention on the small saphenous vein, the patient no longer complained of symptoms. In terms of the clinical picture, there was a significant improvement in the clinical signs, reduction of redness and edema, and complete healing of the finger wound. We present this case because it demonstrates the possibility that in post-stripping patients with significantly inflamed skin, cyanoacrylate vein closure is the safest and most effective procedure in the shortest period. Studies comparing this method with other ablation methods for treating incompetent veins have shown that cyanoacrylate vein closure is non-inferior to other methods and has demonstrated significant efficacy and safety and improved quality of life. [17]

## 5. CONCLUSION

Depending on the severity of the disease and its complications, it is always necessary to choose the best method to avoid additional risks associated with the treatment method itself. Surgical intervention is not suitable when we have acute inflammation just as thermal and radiofrequency ablation are not suitable for treating the lower leg due to the risk of injury to the peroneal-tibial nerve plexus. With the cyanoacrylate closure of the vein under Doppler guidance, these risks are avoided and therefore it is the best option in such cases. But timely diagnosis of venous insufficiency of superficial veins and treatment with all methods prevent serious complications and improve the quality of life.

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