

The postoperative follow-up of varicose vein treatment with N-2-butyl cyanoacrylate application: A case series

Erhan Hafiz

University of Health Sciences, Gaziantep Training and Research Hospital, Department of Cardiovascular Surgery, Gaziantep, Turkey

ORCID ID of the author(s)

EH: 0000-0002-0801-3194

Abstract

N-2-butyl cyanoacrylate application to varicose veins is a novel minimally invasive method for varicose veins. The non-requirement for tumescent anesthesia is the most advantageous feature of this method. However, the intravascular persistence of the administered substance after the procedure has not been evaluated. In this study, the intravascular persistence of N-2-butyl cyanoacrylate was evaluated in the 6th month of administration. Three cases who underwent great saphenous vein ablation treatment with N-2-butyl cyanoacrylate were included in the study. The early postoperative and midterm (6th month) Doppler ultrasonography results were compared. The venous reflux in the sapheno-femoral junction (SFJ) level was totally treated after N-2-butyl cyanoacrylate administration in all patients. Ultrasonography revealed fully filled N-2-butyl cyanoacrylate at the treated levels of the saphenous veins. Similarly, 6th month's ultrasonography examinations revealed that N-2-butyl cyanoacrylate filled the great saphenous vein at the same level. It was observed that the rate of the vessel closed with N-2-butyl cyanoacrylate remained unchanged during six months. According to our results, intravenous N-2-butyl cyanoacrylate remains the same as at the time of administration without any degradation.

Keywords: N-2-butyl cyanoacrylate, Varicose vein, Treatment, Non-degradable

Introduction

Varicose veins disrupt the quality of life due to both cosmetic and physiologic complaints. Medical and surgical treatment are available. Especially the larger varicose veins with progressing venous reflux should be treated with open surgical or minimal invasive techniques. Endovenous laser, radiofrequency or chemical ablation methods can be selected for closure treatment of superficial venous reflux [1, 2]. Intravenous N-2-butyl cyanoacrylate application is one of the popular minimal invasive chemical ablation techniques for treating superficial venous reflux. The most advantageous features of this treatment are non-requirement of tumescent anesthesia and the ablation of varicose veins without high heat energy transfer to tissues [1-3]. However, its long-term intravascular behavior has not been adequately evaluated.

The current study aimed to investigate the midterm intravascular behaviour of N-2-butyl cyanoacrylate with venous Doppler ultrasonography.

Corresponding Author

Erhan Hafiz

University of Health Sciences, Gaziantep Training and Research Hospital, Department of Cardiovascular Surgery, Gaziantep, Turkey
E-mail: erhantr@yahoo.com

Informed Consent

The authors stated that the written consent was obtained from the patients presented with images in the study.

Conflict of Interest

No conflict of interest was declared by the authors.

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Case presentation

After preoperative venous ultrasonography, patients with great saphenous vein diameters higher than 5.5 cm (lower than 11 cm) and a greater than 3-second reflux duration (Figure 1) were selected for N-2-butyl cyanoacrylate ablation treatment. A 6F sheath was placed in the great saphenous vein just above knee under local anesthesia. Thereafter, N-2-Butyl cyanoacrylate was administered to just below the sapheno-femoral junction (SFJ) continuously via the commercially available application set (Musyan™, Noegenix, Ankara, Turkey). Written informed consent was obtained from all patients.

Figure 1: A. Determination of saphenofemoral reflux by Doppler ultrasound B. Measurement of the saphenous diameter by Doppler ultrasound

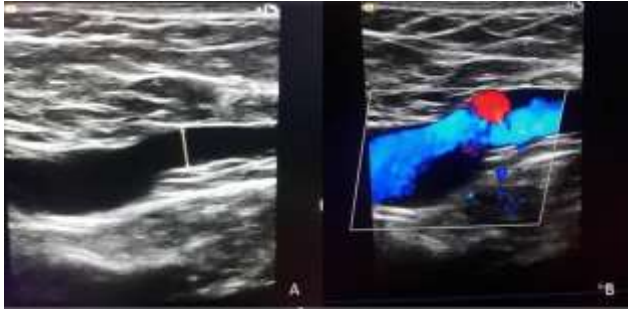


Figure 2: Evaluation of intravenous cyanoacrylate glue (Case 1: same level) by Doppler ultrasound A. Early postoperative period B. Sixth month

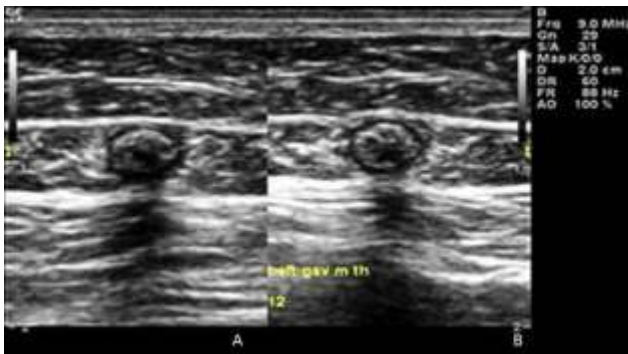


Figure 3: Evaluation of intravenous cyanoacrylate glue (Case 1: same level) by Doppler ultrasound A. Early postoperative period B. Sixth month

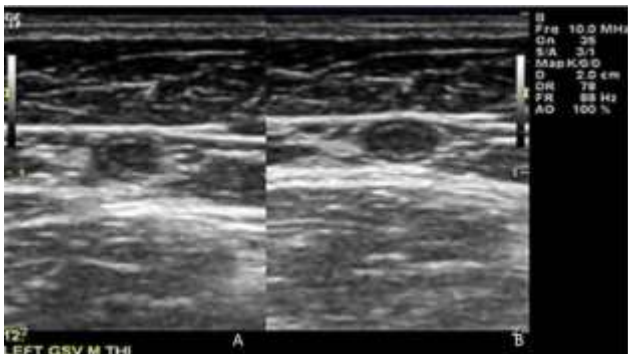
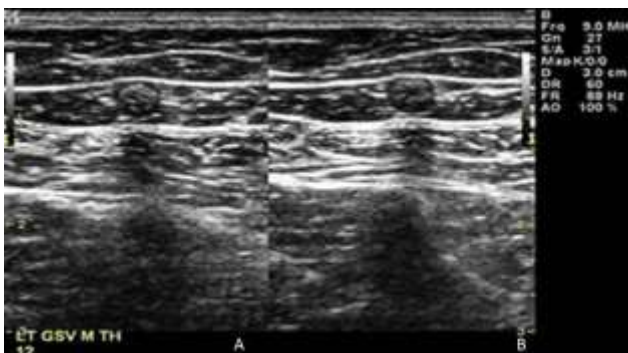


Figure 4: Evaluation of intravenous cyanoacrylate glue (Case 1: same level) by Doppler ultrasound A. Early postoperative period B. Sixth month



Case 1

A 54-year-old male patient visited the hospital with restless leg and edema complaints. Doppler ultrasonography revealed an 8.1 cm diameter of great saphenous vein with more than 5 seconds of venous reflux in the SFJ. The standard intravenous N-2-butyl cyanoacrylate ablation treatment was performed to the great saphenous vein under ultrasonography. The patient was discharged after the operation and the complaints of the patients dramatically regressed. Early postoperative ultrasonography and sixth month ultrasonography results were recorded for evaluating the venous reflux and the visualization of intravenous N-2-butyl cyanoacrylate. Total closure of the vein was observed with N-2-butyl cyanoacrylate at the sixth month without any degradation (Figure 2).

Case 2

A 60-year-old female patient was admitted to the cardiovascular surgery department due to enlarged superficial veins and complaints of poor cosmetic appearance. Doppler ultrasonography revealed a great saphenous vein, 9 cm in diameter, with more than 6 seconds of venous reflux in the SFJ. The standard intravenous N-2-butyl cyanoacrylate ablation treatment was performed to the great saphenous vein under ultrasonography. Additionally, a mini phlebectomy was performed to three varicose branches below the knee. The patient was discharged after the operation. Early postoperative ultrasonography and sixth month ultrasonography results were recorded for evaluating the venous reflux and the visualization of intravenous N-2-butyl cyanoacrylate. Total closure of the vein was observed with N-2-butyl cyanoacrylate at the sixth month without any degradation (Figure 3).

Case 3

A 47-year-old male patient working as a waiter was admitted to the cardiovascular surgery department due to swelling and cramping in the legs. Doppler ultrasonography revealed a great saphenous vein, 7.5 cm in diameter, with continuous venous reflux in the SFJ. The standard intravenous N-2-butyl cyanoacrylate ablation treatment was performed to the great saphenous vein under ultrasonography. The patient was discharged after the operation. His complaints resolved almost completely within a brief time. Early postoperative ultrasonography and sixth month ultrasonography results were recorded for evaluating the venous reflux and the visualization of intravenous N-2-butyl cyanoacrylate. Total closure of the vein was observed with N-2-butyl cyanoacrylate at the sixth month without any degradation (Figure 4).

Discussion

The lower extremity venous system consists of deep and superficial veins and perforating veins connecting them. The deep veins are the main drainage system of the lower extremities. These veins accompany the lower extremity arteries and are typically referred to by the same names as the arteries (common iliac vein, deep femoral vein, etc.) The superficial veins consist of the great saphenous vein (GSV), small saphenous vein (SSV) and the communicating veins that connect these veins. Unlike deep veins, superficial veins are not "indispensable" for the venous drainage of the leg [1-3]. However, venous insufficiency usually occurs over the superficial veins and appears as varicose

veins. Varicose veins are curved, large, palpable veins larger than 3 mm. In developed countries, its incidence tends to increase with age, and it is seen in 65% of women over the age of 45 years and 50% of men. Varicose veins may cause cosmetic problems such as pigmentation, lipodermatosclerosis, and functional limitations in the activities of patients, associated with pain. They may present with complications such as superficial thrombophlebitis (varicophlebitis), ulcerations and bleeding. Family history, advanced age, female gender, pregnancy, obesity, history of deep vein thrombosis, working in occupations that require standing for a long time are the dominant risk factors. Open surgical techniques or minimally invasive laser, radiofrequency or chemical ablation methods can be used in the treatment of varicose venous insufficiency [1-4].

The safe use of cyanoacrylates and the tissue compatibility of N-2-butyl cyanoacrylate, which is one of the long-chain cyanoacrylates, has brought the use of this adhesive material for intravenous treatment to the fore [5, 6]. This material was first documented for human use with N-2-butyl cyanoacrylate by Almeida et al. [4]. The two-year results of these practices were reported in 2015 [7]. The mean length of the vessel segment treated in this study, which included reports of 38 patients with clinical severities (according to CEAP classification) of C2-C4, saphenous diameters ranging from 3 to 12 mm (mean 6.7 mm), and reflux of more than 0.5 seconds, was 8 (9.1) cm. The mean procedure time was 21 minutes, quite short compared to Endovenous laser ablation (EVLA). Comparable to the EVLA method, 24-month closure rates were 92.2% [7]. Analysis of the venous clinical severity scores (VCSS) revealed that pain and edema decreased during follow-up and no paresthesia was observed. Adhesive or thrombus (clot) extension was observed in the SFJ, which resolved spontaneously within three months in the first eight cases (21.1%). It was suggested that administering the first injection 3-5 cm below the SFJ is no longer a problem. The absence of the need to use compression stockings after the procedure is another advantage. In this study, N-2-butyl cyanoacrylate was used as an adhesive [7]. Proebstle et al. [8] reported the results of the first prospective study of administration of N-2-butyl cyanoacrylate on 70 patients in the C2-C4 class with a saphenous diameter ranging from 3 to 10 mm (mean 7.8 mm) and a reflux of >0.5 seconds. In our cases, we observed total occlusion with N-2-butyl cyanoacrylate administration to varicose veins in the early and midterm follow-up period.

Previous studies indicated that the thermal degradation of low molecular cyanoacrylates, starting at the ends of polymer chains, is possible. However, these studies indicated that monomeric alkyl- α -cyanoacrylates can only be degradable at higher temperatures [9]. The other reports claimed that the longer-chain cyanoacrylate derivatives (R=C₄H₉, butyl) show weaker and slower degradation properties that result in safer metabolizing due to the reduced degradation products and decreased intense inflammatory response. It has been stated that this minimal degradation can take years. This is why the degradation products of these long-chain medical bonding materials are also difficult to detect in extraction studies. Because of this confidence interval, longer chain cyanoacrylate monomers are readily accepted by the FDA as medical adhesives

[10, 11]. According to our results, intravenous N-2-butyl cyanoacrylate remained unchanged during the six-month follow-up.

Conclusions

N-2-butyl cyanoacrylate can treat venous reflux by providing total intravenous occlusion. Moreover, the ultrasonography images show that the N-2-butyl cyanoacrylate maintains venous full closure. This result can be interpreted in favor of considering the material as an implant. The long-term intravenous form of N-2-butyl cyanoacrylate should be evaluated to obtain more comprehensive results.

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