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Original Article

Mechanochemical ablation of varicose veins with N-Butyl Cyanoacrylate: Six-month follow-up

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Abstract

Aim: The endovenous treatment with n-butyl cyanoacrylate (NBCA) is a new nontumescent ablation technique for symptomatic saphenous vein reflux. The aim of the present study is to present six-month follow-up results of NBCA (VenaBlock) mechanochemical ablation technique.

Material and Methods: Endovenous ablation was performed on 29 saphenous veinsof 23 patients between January 2017 and October 2018 in our university hospital. All patients with six-month follow-up results were included. Patients' pre- and postoperative data were recorded.

Results: This procedure was performed on eight small saphenous veins in seven patients and 21 great saphenous veins in 16 patients. The mean saphenous vein diameters for great and small saphenous vein were 7.1 and 3.8, respectively. The mean lengths for great and small saphenous vein were 45 cm and 19 cm, respectively. Closure rates were 100% at one week, 100% at one month, 100% at three months and 96% at six months. CEAP score was significantly improved ($p<0.001$). There was one deep venous thrombosis patient as a complication.

Conclusion: The NBCA-based vein ablation technique is a fast end affective treatment method with no tumescent anesthesia requirement and high patient toleration. Further large-scale studies with long-term follow-up results are required.

Keywords: Venous insufficiency; mechanochemical ablation; varicose veins; endovenous ablation.

INTRODUCTION

Chronic venous disease (CVD) is a common and progressive disease which has a negative influence on the patient's life quality (1). Although previously the first option was surgical stripping in the treatment of CVD, it has greatly given way to thermal ablation methods such as endovenous radiofrequency and laser ablation (2). While these thermal methods cause decrease in complication rates and increase in patient comfort when compared with surgery, their main disadvantage is requiring tumescent anesthesia (2). In addition to being performed to protect the surrounding tissue from thermal injury during thermal ablation, tumescent anesthesia requires additional time and it has side effects which decrease patient comfort such as pain, hematoma and ecchymosis (2). Recently, mechanochemical ablation methods based-on n-butyl cyanoacrylate (NBCA) which do not require tumescent anesthesia have been developed and it claims that this method decrease side effects and provide effective treatment.

The aim of the present study was to present the short term results of NBCA-based mechanochemical ablation method in patients with saphenous vein insufficiency.

MATERIAL and METHODS

Patients

Our institutional ethics committee approved this retrospective study. A retrospective search of the hospital database was queried to identify patients who were treated with NBCA-based sealing system. Among those, patients whose 6-month follow-up was available were included in the study. Patients' medical records were reviewed. Vein ablation was performed on 29 saphenous veins of 23 patients between January 2017 and October 2018. Patients who were found to have insufficiency in saphenous veins with color Doppler ultrasonography (USG) were applied treatment. Treatment criteria were having a diameter of 5.5 mm and greater for great

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saphenous vein and a diameter of 4 mm and greater for small saphenous vein and above 0.5 sec. reflux. Exclusion criteria from treatment are shown in Table 1. After informing, written consents of patients obtained from all patients before the procedure, the patients were taken in interventional radiology unit. The patients were asked to refer to the hospital for follow-up visit three days after the procedure. Later, 1-week, 1-month, 3-month and 6-month follow-ups were performed by an experienced radiologist clinically and with color Doppler USG. In addition, the patients were asked to refer to hospital immediately in case of experiencing sudden edema, pain, hematoma and shortness of breath.

Procedure

All procedures were performed by interventional radiologists experienced in endovenous laser ablation (EVLA) and radiofrequency ablation of varicose veins (RFA). No problems occurred in the cases during catheterization and ablation. Saphenous vein was catheterized through 6F introducer sheath under the guidance of Doppler USG. 5F catheter was also forwarded by confirming the position with Doppler USG. Approximately 6 cm catheter tip was spaced out between SPJ/SFJ, because 4F delivery micro-catheter goes 3 cm forward from 5F catheter tip. As a result, 4F catheter was positioned 3 cm away from SPJ or SFJ and NBCA injection groundwork was completed. The position of the catheter tip was also confirmed with the guiding light on catheter tip and the position of the catheter was followed with guiding light during the procedure. NBCA was aspired in 2 cc injector. The injector was tied to gun adaptor and the delivery catheter was locked with a spin lock mechanism. Next, the procedure started. Pressure was applied to SFJ or SPJ and the vein was compressed in this area and it was confirmed with Doppler USG. Prior to the injection of NBCA inside the vein lumen, the delivery catheter was primed. One trigger push was applied for one second to prime the delivery catheter. After priming, the trigger was pushed again for 5 s, and this time the delivery catheter was pulled back at 2 cm/s. The delivery catheter was set up for the injection of 0.03 cc of NBCA/cm. Continuous pressure was applied over the target vein segment simultaneously with the pulling back of the delivery catheter by the Doppler USG probe without releasing the pressure from the SFJ. This trigger-pressing and pressure application was performed routinely until the target vein segment was completely sealed. After the procedure, ablation of the vein was assessed immediately by the radiologist with color Doppler USG. All the patients used oral non-steroid anti-inflammatory agents (NSAIDs) and anti-acid drugs routinely for 5 days in order to decrease the local inflammation and pain that occurred after ablation. Bandage was put on the patients' ablated segments and they were discharged and the patients were asked to use stocking socks for two weeks.

Statistical Analysis

Patients' demographic characteristics, venous insufficiency characteristics, results, complications and follow-up results were described for all patients. Statistical analysis was performed on SPSS 22.0 for Windows (SPSS Inc., Chicago, IL, USA) software. Frequency and percentage values of categorical variables as well as median and range of continuous variables were determined. We compared data using the independent t tests for continuous variables. Venous occlusion level at six-month follow-up was determined using Kaplan-Meier analysis. A probability value of less than 5% was considered significant.

RESULTS

Table 2 shows patients' demographics and procedural and clinical information. While most of the patients were male, the number of female patients was close (52%). The most frequent CEAP was class C2. 29 saphenous veins in 23 patients were treated. This procedure was performed on eight small saphenous veinsin seven patients and 21 great saphenousveins in 16 patients. The mean saphenous vein diametersfor great and small saphenous vein were 7.1±2.3 and 3.8±1.4, respectively. The mean lengths for great and small saphenous vein were 45±8 cm and 19±5 cm, respectively. Average injected NBCA amount was 2 cc for GSV and 1.2 for SSV and maximum 3 cc injection was made. In all cases, following the procedure, it was confirmed that saphenous veins were ablated using Doppler USG. During NBCA injection, the patients did not have any intolerable complaints of pain; however, in 10% of the patients, there was a mild short term pain in the first injection and while the set came out of the vein. The patients were able to return to their normal life on the same day following the procedure. All of the 21 great saphenous veins were accessed from under the knee. In 15 of these, the access was made from above the ankle area. 5 of the patients (21%) received sclerotherapy for their varicose veins in their early control on the third day. Local anesthesia was performed and under the guidance of Doppler USG varicose veins were treated with polidocanol 2%. Closure rates were 100% at one week, 100% at one month, and 96% at six months. Procedure was repeated on one patient who developed recanalization following the six-month control and complete closure was observed in early period following the procedure. CEAP scores of patients were significantly improved ($p<0.001$). The most frequent side effects were complaints such as abnormal erythema, edema, pain, sensitivity and rash on the skin, which are defined as 'abnormal skin reaction'. 'Abnormal skin reactions' were seen in 9 (39%) of the patients. 'Abnormal skin reactions' complaint which started on the 5th day on average completely regressed in two weeks. Paresthesia was not seen in the patients. Pigmentation was seen at vascular access point in one patient. At three-month follow-up pigmentation was regressed. There was one deep venous thrombosis patient as a complication. Deep venous thrombosis occurred 5 days after the procedure. In this patient, glue was limited within saphenous vein in Doppler examination and there was no glue extension to the main femoral vein. Thrombophilia panel was investigated in the patient and no comorbid disease was found. Based on the anamnesis, the cause of

deep venous thrombosis was thought to being immobile for a long time and not moving the legs. The patient was treated medically.

Table 1. Exclusion criteria (NBCA-based Treatment)

1. Patients under the age of 18
2. Patients with obstruction in deep venous system
3. Patients with cardiac and renal failure
4. Hypercoagulability status
5. Local or systemic infection
6. Immobile patients

Table 2. Patient and Procedure Characteristics

Characteristics	Value
Number of patients	23
Man	12
Woman	11
CEAP score Pre-procedural; Post-procedural	
C1	6;19
C2	12;2
C3	3;1
C4	2;1
Ablated veins	29
GSV	21
SSV	8
Mean saphenous vein diameter (cm); length (cm)	
GSV	7.1±2.3; 45±8
SSV	3.8±1.4; 19±5

Table 2. Adverse events: Six months follow-up

Adverse events	Patients, n (%)
Abnormal skin reactions	9 (39%)
Pigmentation	1 (4%)
Deep venous thrombosis	1 (4%)
Paresthesia	0 (%)

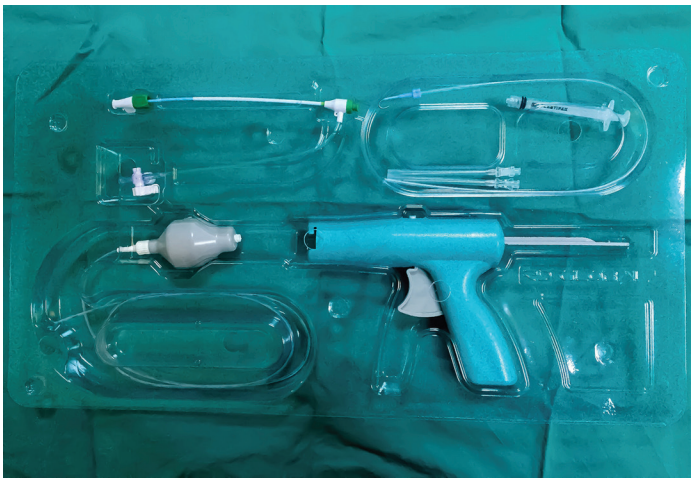

Figure 1. The content of VenaBlock sealing set.

DISCUSSION

This study demonstrates that NBCA-based ablation system is an effective treatment method. Mechanochemical ablation methods promise patients high comfort with short-termed procedure (3). NBCA given with VenaBlock device gives fast polymerization reaction with 5 seconds and continuous delivery and pressure on the vein following NBCA injection are the important points of the procedure (4) (Figure 1). With this treatment method, it is important to stick the opposing endothelium layers of the vein without forming thrombus formation inside.

The first use of NBCA in the treatment of varicose veins depends on the experimental study conducted by Almedia et al. in 2011 (5). Following this, the first clinical study was published in 2013 (6). In 2014, Toonder et al. published the study in which they used NBCA for perforating vein deficiency (7). In 2015, the study comparing NBCA and RFA was published by Morrison et al. and it was reported that both methods had similar efficiency and safety (8). In 2016, Bozkurt and Yılmaz published the first study comparing NBCA and EVLA (9). In this study, EVLA and NBCA ablation were found to have results similar to comparison with RFA. Following this, Eroglu et al, Park et al and Yasim et al. published their NBCA-based ablation results with 100% closure rates (1,2,4). Yavuz et al., Ovali et al. and Sarac et al. found closure rates close to complete closure with follow-up times of 24 months by using VenaBlock sealing set similar to our study (4,10,11). However, there were some complications related to treatment and majority of these complications was 'abnormal skin changes' which are also called as phebilitis in some previous studies. In a systematic review consisting of 1000 patients and published by Bissacco et al. in 2018, the most common side effect was pain in mechanochemical ablation studies conducted with NBCA, while no pain complaint was seen in the patients expect for a mild pain during the procedure (3). In our study, the patients had high procedural toleration and during the procedure, general anesthesia was not required. All the procedures were performed with local anesthesia. In our study, complications defined as 'abnormal skin changes' were mildly high when compared with some previous studies. We believe 'abnormal skin changes' occurring after an NBCA procedure relates to an excess amount of glue in a certain vein segment, causing reaction with blood and creating a thrombus like formation. In our study, the reason why this complication rate is high can be the fact that sufficient pressure is not performed on the vein following NBCA injection. In addition, it can be necessary to avoid giving NBCA inside the vein with sudden bolus style. 'Abnormal skin changes' were found in high rates in female patients (3). A similar result was found in Park et al. and they reported that they would continue investigating since they could not report the actual cause (2). We believe that the weakness in connective tissue of female patients can be the main reason causing this. For this reason, it may be necessary in female patients to adjust the NBCA dose to be used and to emphasize the pressure on veins following

injection. In our study, female patients had high rates of closure, similar to literature. Unlike previous studies, deep vein thrombosis occurred unexpectedly on the 5th day of the procedure on one of the patients. The patient's procedure was problem free. Third day Doppler follow-up showed complete closure and there were no complaints except for mild ecchymosis at the entrance point to the vein. However, on the 5th day deep venous thrombosis occurred in the patient and medical therapy was started. The patient did not have any comorbid disease that could cause thrombosis. Based on the anamnesis, we thought that the patient was undergoing deep venous thrombosis as a result of being immobile for a long period of time. The patient was treated with medical treatment.

Our study has some limitations such as being retrospective, having few patients and a heterogeneous population consisting of great-small saphenous veins. In addition, 6-month follow-up period is a short period of time and the effects of VenaBlock NBCA delivery system on the treatment of chronic venous disease and complication rates should be researched with multi-centered studies having high numbers of patients.

CONCLUSION

In conclusion, NBCA-based mechanochemical ablation has several advantages, such as no need for tumescent anesthesia, improved patient comfort, short procedure duration and ease of application. Therefore, NBCA-based mechanochemical ablation seems to be an effective technique for managing symptomatic saphenous venous insufficiency based on this observational study in the short-time period.

Competing interests: The authors declare that they have no competing interest.

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Ethical approval: All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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