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Ultrasound-guided perforator vein sealing with cyanoacrylate glue

Siyanoakrilat yapıştırıcı ile ultrason kılavuzluğunda perforatör ven mühürleme

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ABSTRACT

The introduction of the cyanoacrylate into the blood vessel triggers a polymerization reaction that further causes an occlusion in the affected vessel. This effect has been used for the treatment of various vascular disorders including the cerebral arteriovenous malformations and aneurysms. The endovenous administration of the cyanoacrylate has recently started to be used for the treatment of incompetent lower extremity venous system as well. In this article, we report an endovenous administration of cyanoacrylate with the ultrasound guidance into the posterior tibial (Cockett-2) perforator vein and eventual treatment of the incompetent vein. This case demonstrates that this athermal treatment modality for the perforator veins may become an alternative to the successfully used current thermal methods.

Keywords: Cyanoacrylate; insufficiency; perforator vein.

ÖZ

Siyanoakrilatın damar içine verilmesi bir polimerizasyon reaksiyonunu tetikler, bu da etkilenen damarın tıkanmasına yol açar. Bu etki, serebral arteriyovenöz malformasyonları ve anevrizmaları içeren çeşitli vasküler bozuklukların tedavisinde kullanılmaktadır. Endovenöz siyanoakrilat uygulaması, yetmezlik olan alt ekstremite venöz sisteminin tedavisinde de yakın zamanda kullanılmaya başlandı. Bu yazıda, ultrason kılavuzluğunda posterior tibial (Cockett-2) perforatör vene endovenöz siyanoakrilat uygulanması ve yetmezlik olan venin tedavisi sunuldu. Bu olgu, perforatör venlere yönelik bu atermal tedavi yaklaşımının günümüzde başarıyla kullanılan termal yöntemlere bir alternatif olabileceğini göstermektedir.

Anahtar sözcükler: Siyanoakrilat; yetmezlik; perforatör ven.

Chronic venous insufficiency is seen in 10 to 35% of the adult population. Over the 65 years of age, the incidence of venous ulcer rises to 4%.[1] Lower extremity venous system can be studied in four parts, the deep venous system, superficial venous system, communicating (perforating) venous system, and the microcirculatory venous plexus. The increased venous pressure in either of these systems may result in lower extremity venous insufficiency symptoms.[2] Valvular insufficiency, venous obstruction or poor muscle pump action play a role in pathogenesis. Increased venous pressure is the initial pathology that further causes an increased capillary permeability. Extravasation of the macromolecules and the erythrocytes lead to edema. Hemosiderin collection gives the characteristic brown skin color and results in hyperpigmentation and lipodermatosclerosis. Eventual progression to ulcer becomes inevitable when left untreated.[1,2]

Endovenous delivery of the cyanoacrylate (CA) glue has been used as a new procedure for the treatment of venous insufficiency.[3] It is a non-ablative technique, and was accepted as an implantable medical device in the United States for the treatment of cerebral arteriovenous malformations (AVMs) and intracranial aneurysms.[4] In this article, we present a different usage of the CA glue in the incompetent perforator veins (PVs) of the lower extremity.

CASE REPORT

A 38-year-old female patient admitted to our outpatient clinic with complaints of edema and itching on her left leg. Physical examination revealed a Clinical-Etiology-Anatomy-Pathophysiology class-3 signs on her left leg. Color Doppler ultrasound (DUS) showed an insufficiency in the posterotibial perforator (Cockett-2) vein of the affected limb (Figure 1).

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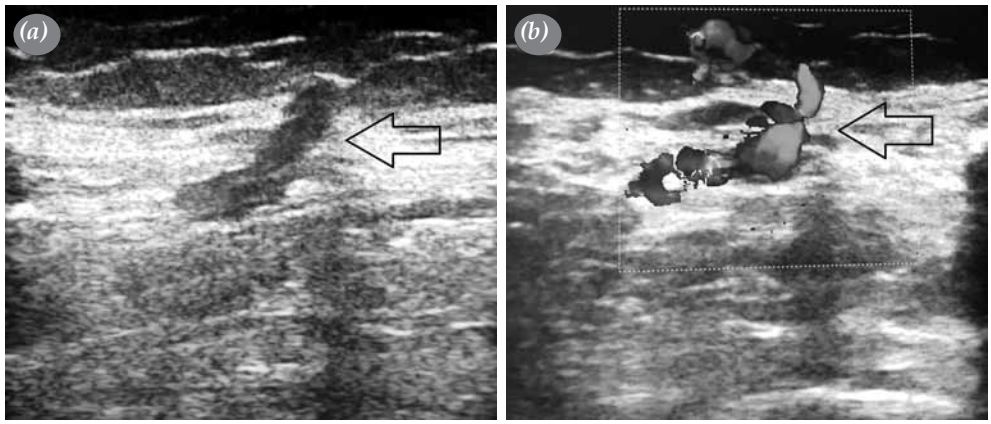

Figure 1. (a) Ultrasound image showing dilated Cockett-2 perforating vein. **(b)** Color Doppler ultrasound image showing Cockett-2 perforating vein with massive insufficiency.

The great saphenous vein and the small saphenous veins were totally normal. The Cockett-2 PV was punctured percutaneously under the DUS guidance, and the CA glue (VariClose® Biolas, FG Group, Ankara, Turkey) was injected into the vein. After five minutes of external compression over the vein, the DUS images demonstrated the collapsed PV with no remaining incompetent blood circulation (Figure 2).

During the injection, some points should be watched out. Puncture of the incompetent PV should be performed carefully under the guidance of a DUS. Needle syringe gauge size is important as the vein has a tortuous shape. A thin needle might be unable to conduct the glue efficiently, while a too thick needle might damage the target vein. We preferred to use 22 gauge needle with a green hub (1x1/2" in size, 0.80 mm diameter) in this case. Lidocaine hydrocloride was used as the local anesthesia during the procedure. After puncturing the PV, blood is withdrawn to ensure that the needle is inside the vein. Then, the needle is stabilized with one hand and irrigated antegradely with a saline solution to wash out the blood inside the needle before the administration of the glue. Otherwise, the CA glue encounters and reacts with the blood inside the needle lumen prematurely causing an obstruction. This obstruction makes the injection impossible. The glue should be conducted to the target without any interaction with blood inside the needle. As dosage, 0.5 mL of CA glue is sufficient for an incompetent PV. After the injection of the glue, the PV should be externally compressed and left at least five minutes under pressure. This enables the adherence of the endothelium and sealing also preventing a possible glue embolization through the deep venous system.

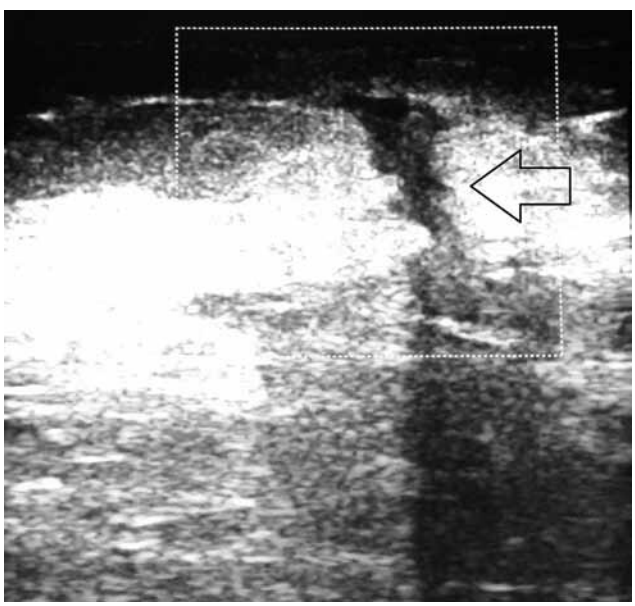

Figure 2. Perforator vein was filled with cyanoacrylate glue and revealed no color inside the vein.

DISCUSSION

Perforator veins of the lower extremities may entirely be responsible for chronic venous insufficiency symptoms and leg ulcers in the absence of an axial vein insufficiency. Subfascial endoscopic ligation (SEPS), percutaneous thermal ablation, and the DUS-assisted ligation with mini incisions are the preferred methods for the current perforating vein treatment.[5] After a long period of open surgery history, the SEPS procedure had been proved to be a worthy alternative until less invasive techniques were introduced in the late nineties.[6] Percutaneos endovenous thermal ablation techniques have still been successfully used with high closure rates in axial veins as well as the PVs.[7] However, thermal ablation techniques require

tumescent anesthesia to prevent the potential damage to the surrounding tissues such as nerves in axial vein ablation.[6] Application of the tumescent anesthesia needs multiple needle punctures to direct large amounts of perivenous anesthetic solution to shrink the vein diameter and to create a thermal barrier to prevent the adjacent structures from heat damage.[8] Cyanoacrylate glue treatment is also called athermal or chemical ablation since it needs no tumescent anesthesia and does not produce a heat energy.[3] It is thus safer compared to the thermal ablation techniques for axial vein ablation in terms of a probable neurological damage.[8] However, advantage of lacking tumescent anesthesia could be a part of the axial vein closure procedures but not for just a small PV sealing procedure. The mentioned thermal methods as well as the CA glue could also be used without tumescent anesthesia using only a local anesthesia as in this case.

Cyanoacrylate, commonly called as a superglue, has been started to be used recently for the treatment of some vascular pathologies such as AVMs, pelvic congestion syndromes, and varices.[8,9] Although it has been used with permission for the endovascular procedures in Europe, its approved usage could not be achieved until 2000 when Trufill® (Cordis, Miami Lakes, Florida, USA) received Unites States Food and Drug Administration clearance for cerebral AVM embolizations.[4]

Biochemically, CA glue triggers a robust inflammatory reaction in the vessel wall. Anionic substances like the blood or plasma stimulate the polymerization upon contact leading to occlusion.[8] The resultant polymers destroy the intima and cause an acute immunological response.[10] After the polymerization is completed, the gradual resorption of the occlusive polymers take place.[11] In approximately one month, the cellular response progresses to the granulomatous giant cell formation ending with a permanent fibrosis.[12]

Previous alternative minimal invasive athermal method for the treatment of venous insufficiency was the foam sclerotherapy. The DUS-guided sclerotherapy has gained worldwide popularity; however, it has a significant tendency for systemic embolization with every injection.[8] Venous embolization of the foam sclerosants have been well tolerated, but the arterial ones have caused devastating effects.[13] Although CA is considered to be safer than the other sclerosants, it has a theoretical risk of deep vein thrombosis. Therefore, the peripheral emboli still can rarely be encountered despite the faster polymerization time.[14]

In conclusion, color Doppler ultrasound-guided perforator vein sealing with a cyanoacrylate glue can be effectively used in perforator vein insufficiency. It is a non-thermal and non-tumescent method alternative to the thermo-ablation devices as well as the previously used foam sclerotherapy.[6] Depending on the success and the safety of the cyanoacrylate in the occlusion of the vascular malformations, this glue may be a viable treatment alternative for the lower extremity perforator vein insufficiencies.[8]

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REFERENCES

1. Pappas PJ, Lal BK, Cerveira JJ, Padberg FT Jr, Duran WN. Causes of severe chronic venous insufficiency. Semin Vasc Surg 2005;18:30-5.
2. Beebe-Dimmer JL, Pfeifer JR, Engle JS, Schottenfeld D. The epidemiology of chronic venous insufficiency and varicose veins. Ann Epidemiol 2005;15:175-84.
3. Almeida JI, Javier JJ, Mackay E, Bautista C, Proebstle TM. First human use of cyanoacrylate adhesive for treatment of saphenous vein incompetence. J Vasc Surg Venous Lymphat Disord 2013;1:174-80.
4. Pollak JS, White RI Jr. The use of cyanoacrylate adhesives in peripheral embolization. J Vasc Interv Radiol 2001;12:907-13.
5. Basbug HS, Bitargil M, Babaroğlu S, Günerhan Y, Göçer H, Özışık K. Is color Doppler ultrasound-assisted perforating vein ligation with a mini-incision still a viable alternative? Turk Gogus Kalp Dama 2015;23:493-8.
6. Toonder IM, Lam YL, Lawson J, Wittens CH. Cyanoacrylate adhesive perforator embolization (CAPE) of incompetent perforating veins of the leg, a feasibility study. Phlebology 2014;29:49-54.
7. Harlander-Locke M, Lawrence PF, Alktaifi A, Jimenez JC, Rigberg D, DeRubertis B. The impact of ablation of incompetent superficial and perforator veins on ulcer healing rates. J Vasc Surg 2012;55:458-64.
8. Almeida JI, Min RJ, Raabe R, McLean DJ, Madsen M. Cyanoacrylate adhesive for the closure of truncal veins: 60-day swine model results. Vasc Endovascular Surg 2011;45:631-5.
9. Romero-Castro R, Pellicer-Bautista FJ, Jimenez-Saenz M, Marcos-Sanchez F, Caunedo-Alvarez A, Ortiz-Moyano C, et al. EUS-guided injection of cyanoacrylate in perforating feeding veins in gastric varices: results in 5 cases. Gastrointest Endosc 2007;66:402-7.
10. Levrier O, Mekkaoui C, Rolland PH, Murphy K, Cabrol P, Moulin G, et al. Efficacy and low vascular toxicity of embolization with radical versus anionic polymerization of n-butyl-2-cyanoacrylate (NBCA). An experimental study in

the swine. J Neuroradiol 2003;30:95-102.
11. Vinters HV, Galil KA, Lundie MJ, Kaufmann JC. The histotoxicity of cyanoacrylates. A selective review. Neuroradiology 1985;27:279-91.
12. Spiegel SM, Viñuela F, Goldwasser JM, Fox AJ, Pelz DM. Adjusting the polymerization time of isobutyl-2 cyanoacrylate. AJNR Am J Neuroradiol 1986;7:109-12.
13. Forlee MV, Grouden M, Moore DJ, Shanik G. Stroke after varicose vein foam injection sclerotherapy. J Vasc Surg 2006;43:162-4.
14. Gupta K, Vasishta RK, Dutta U, Kochhar RK, Singh K. Embolization of cyanoacrylate glue in systemic circulation in a case of hepatocellular carcinoma: an autopsy report. Diagn Pathol 2009;4:45.