Real-time Ultrasound-guided Ethanol Sclerotherapy of a Symptomatic Venous Malformation: a case report

Ming-Hsun Lee1 Hong-Jen Chiou1,2 Yi-Hong Chou1,2 Hsin-Kai Wang1,2 Chao-Hsuan Yen1,2 Cheng-Yen Chang1,2

Department of Radiology1, Taipei Veterans General Hospital
College of Medicine2, National Yang-Ming University

A 13-year-old girl had a venous malformation at her abductor pollicis longus muscle of right forearm, with clinical presentation of local swelling, tenderness and inability to abduct her thumb. Under sonographic guidance, we treated this lesion with percutaneous intralesional ethanol injection. Her symptoms soon resolved after the treatment. In a follow-up period of 8 months, persistently decreased size of the lesion was observed without recurrence of symptom. We believe that US-guided ethanol injection is an easy, effective and safe therapy in relieving symptom associated with the venous malformation.

Venous malformations are the most common vascular malformations [1]. The diagnosis of venous malformation could usually be done if there are typical clinical and imaging findings. These lesions are present at birth, tend to enlarge over time in proportion to the growth of the patient and do not spontaneously regress [2]. Most common symptoms include pain and swelling, which depend on their size and location. Under sonography, they usually appear as hypoechoic and heterogeneous masses with compressibility [3]. Sometimes, acoustic shadowing produced by phleboliths could be found. Current management of these symptomatic lesions includes medical treatment, sclerotherapy and surgical resection [4]. Herein, we report a case with symptomatic intramuscular venous malformation, which was successfully treated by intralesional ethanol injection under real-time US-guidance [5].

CASE REPORT

A 13-year-old girl presented with intermittent local swelling, tenderness at right forearm and was unable to abduct her thumb. During physical examination, a soft mass was palpated without visible skin abnormality. Sonography revealed an ill-defined mass with heterogenous echogenicity at her abductor pollicis longus muscle of right forearm (Fig. 1). It was measured about 62 × 22mm in size. Some anechoic cystic structures and echogenic phleboliths with acoustic shadowing were found in the lesion. Compressibility of the lesion under real-time ultrasound examination was observed (Fig. 2a, 2b). Color Doppler study with spectral analysis demonstrates flow signals in the cystic spaces with venous pattern (Fig. 3). The clinical presentation and sonographic findings were typical for diagnosis of intramuscular venous malformation [3]. After informed consent was obtained, she was admitted for further treatment. Before the sclero-
US-guided ethanol sclerotherapy of venous malformation

therapy, a tourniquet was applied at her forearm proximal to the lesion in order to minimize passage of the ethanol into the systemic circulation. Under US guidance, we directly punctured the center of the mass with a 21 gauge needle and absolute ethanol was slowly injected into the lesion. After complete obliteration of the lesion, which was confirmed by real-time US monitor (Fig. 4a, 4b), the injection of ethanol was stopped and totally 5mL of ethanol was used. Multiple echogenic spots within the vascular space were found during the procedure, which were compatible with air-bubbles caused by ethanol injection. After one day of observation, she was discharged without remarkable discomfort.

Her thumb gradually regained the ability of abduction after the treatment, and the local swelling and tenderness of the forearm subsided. Follow-up sonography was performed at one day, 2-, 5- and 8- month after treatment (Fig. 5), which revealed

Figure 1. Longitudinal scan of grayscale US showed an ill-defined mass (A, arrowheads) in the muscle layer of right forearm with heterogenous echogenicity. Some anechoic tubular structures were noted within the lesion. An echogenic phlebolith with acoustic shadowing was noted (arrow).

Figure 2. Transverse scan a. showed some anechoic cystic structures (asterisk) within the lesion (arrowheads). After compression b. obliteration of these cystic structures was noted.

Figure 3. Color Doppler scan with spectral analysis demonstrated undulating flow signals in the cystic spaces, which was caused by manual compression of the lesion and relief.
US-guided ethanol sclerotherapy of venous malformation

gradual shrinkage of the lesion from 62 × 22mm to 24 × 7mm. Markedly decreased flow signal and disappearance of venous lakes were also confirmed in the Color Doppler images.

**DISCUSSION**

Several classification systems for vascular anomalies were proposed. Among them, the most widely accepted one was described by Mulliken and Glowacki in 1982, which classified vascular anomalies into two major categories - vascular tumors (eg, hemangiomas) with endothelial hyperplasia, or vascular malformations with normal endothelial turnover, according to their clinical behavior, histology and histochemistry [6]. Later, this classification system was accepted and updated during the 1992 meeting of the International Society for the Study of Vascular Anomalies (ISSVA) [7]. According to the flow pattern, these malformations could also be classified as slow-flow malformations (capillary, venous, lymphatic, capillary-venous, and capillary-lymphatic venous malformations) and high-flow malformations (arteriovenous fistulas, arteriovenous malformations).

Venous malformations are composed of thin-walled, dilated, sponge-like abnormal channels of variable size and thickness [7]. Both the superficial structures (skin, subcutaneous tissue) and deeper structures may be involved. They typically represent as soft, compressible and nonpulsatile soft tissue masses. The overlying skin may appear bluish in color. These masses are present at birth and grow in proportion to the child. During puberty and pregnancy, they often enlarge and do not regress [4].

In plain radiography, the venous malformations usually represent as soft tissue masses occasionally associated with phleboliths. Under sonography, venous malformation typically appears as hypoechoic, heterogeneous masses with compressibility [3]. When phlebolith exists, it may also cause acoustic shadowing. Color Doppler usually reveals monophasic, low-velocity venous signal,

**Figure 4.** US-guided intralesional ethanol injection. **a.** Longitudinal scan showed the echogenic needle (arrow) in the lesion (arrowheads) and obliteration of surrounding vascular spaces by ethanol injection. **b.** Longitudinal scan after 5 mL ethanol injection revealed multiple echogenic spots (curved arrow) within the vascular space, which were compatible with air bubble formation.

**Figure 5.** Eight months after treatment, Color Doppler scan showed marked decrease of tumor size (arrowheads), obliteration of cystic spaces, and decreased vascularity.
although it may be undetectable in some lesions with slow blood flow [3]. In magnetic resonance (MR) imaging, lesions are usually hypo- or isointense at T1-weighted sequences and hyperintense on T2-weighted sequences [4, 8]. Area of heterogeneous signal intensity can be observed in case of hemorrhage and thrombosis. After administration of intravenous gadolinium, these lesions usually show inhomogeneous enhancement. In our case, presence of echogenic phleboliths with acoustic shadowing, compressibility under real-time sonographic examination, venous flow on color Doppler US in combination with typical clinical appearance allow confident the diagnosis of venous malformation.

Treatment of these malformations is indicated when they cause symptoms, such as swelling, pain, and functional impairment. A broad variety of management had been proposed, including sclerotherapy, surgery, irradiation, electrocoagulation, cryotherapy. For very superficial forms of venous malformation, laser therapy can be helpful. In other cases, sclerotherapy with or without surgery is the current treatment of choice [1, 4, 9].

Several kinds of agents had been used in sclerotherapy, including absolute ethanol, polidocanol, ethanolamine oleate, n-butyl cyanoacrylate [1, 10]. Absolute ethanol is an effective agent in treating venous malformation, but is also associated with some important side effects, such as skin blistering or necrosis, tissue swelling and peripheral nerve palsy. If large amount of ethanol is used, it can cause systemic effects, such as hypoglycemia, rhabdomyolysis, central nervous system depression, pulmonary vasospasm, cardiac arrhythmias, and even cardiopulmonary collapse [11, 12]. The maximal dose of ethanol used per session less than 0.8-1.0 mL/kg had been recommended to avoid these systemic complications [11, 12]. In our case, the total doses of ethanol used was 5mL (0.11 mL/kg), which was far below the suggested safety dose. And although there was no obvious high velocity flow in the prior Color Doppler scan, a tourniquet was still applied proximal to the lesion to prevent abrupt elevation of systemic ethanol concentration.

During the sclerotherapy, fluoroscopic control is advised in order to estimate the amount of sclerosing agent required, and to avoid extravasation and sclerosis of draining veins [1, 4, 9]. In our case, we chose real-time US monitor instead of fluoroscopic control because of the small size and relatively localized nature of this lesion, which allowed us to visualize the extent of ethanol infiltration clearly in the field-of-view, and to avoid unnecessary extravasation or incomplete ablation of the lesion.

Most studies showed satisfactory results in functional improvement and reduction of lesion size after the sclerotherapy, although recanalization and recurrence may occur and multi-session sclerotherapy or surgical may be necessary [8, 13]. In our case, percutaneous ethanol injection effectively relieved the symptoms, and the lesion size regressed from 62 × 22mm to 24 × 7mm at the 8-month follow-up. Only mild wound pain was noted transiently after the procedure.

In conclusion, sonographically guided percutaneous injection of ethanol for sclerosis of peripheral venous malformation is a simple and effective treatment of choice. Under careful real-time monitor and adequate flow control, complications could be avoided.

**REFERENCE**

11. Hammer FD, Boon LM, Mathurin P, Vanwijck RR. Ethanol sclerotherapy of venous malformations: evalu-
US-guided ethanol sclerotherapy of venous malformation


以超音波導引經皮酒精栓塞治療具症狀的肌肉內靜脈血管畸形：病例報告

李明勳\textsuperscript{1}  蕭宏仁\textsuperscript{1,2}  周宜宏\textsuperscript{1,2}  王信凱\textsuperscript{1,2}  顏昭璜\textsuperscript{1,2}  張政彥\textsuperscript{1,2}

台北榮民總醫院 放射線部\textsuperscript{1}
國立陽明大學 放射線學科\textsuperscript{2}

一位十三歲大的女孩於左前臂發現一腫塊，造成局部腫脹、壓痛並且無法做拇指的外展動作。經超音波檢查後，發現此腫塊具有典型的影像學特徵，因此診斷為靜脈血管畸形。在超音波導引下，我們對此病灶以經皮酒精注射的方式完成栓塞治療。此病患的症狀在治療後即得到緩解。在治療後八個月的追蹤中，此病灶的大小持續的下降，血流性也回復到正常基準。我們認為經皮酒精栓塞對於靜脈血管畸形所引起的症狀可以做有效的控制。