A successful percutaneous ethanol stellate ganglion block on ventricular tachycardia storm

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Tweet. The left ultrasound-guided stellate ganglion block is a more effective method in patients with recurrent ventricular tachycardia as an emergence unit. Using ethanol instead of lidocaine showed high and stable efficiency.

Keywords: Ventricular tachycardia storm; Stellate ganglion; Cardiac denervation; Ischemic dilated cardiomyopathy; Heart failure.

Abstract. The stellate ganglion block should be as emergency therapy in patients with HF and VT storm, because of to the patient's hemodynamic status in the

condition of ICU. This method used urgently and reduced life-threatening VT, when conservative and interventional methods were ineffective.

Introduction

The stellate ganglion (SG) is a ganglionic formed by the fusion of the lower cervical and first thoracic sympathetic ganglion [1]. As a single structure, among the cervical ganglion, it has an average of 2.5 cm in length, 1 cm in width, and 0.5 cm in thickness. The stellate ganglion innervates the vertebral artery, the organs of the thoracic cavity (esophagus, trachea, thymus gland, and aorta) and the heart muscle. Although the SG block (SGB) has been practiced for many years, there is no clarity about the safe method for a successful block. The SG block can be executed at the C6 or C7 level with the help of imaging tools like ultrasonography (USG) and radiography [2].

Ventricular tachycardia (VT) storm – is an emergency and life-threatening condition that involves repetitive ventricular tachyarrhythmia. The concept of a specific sympathetic imbalance on VT storm (increased activity of the left stellate ganglion) is the basis of surgical treatment – left-sided sympathetic denervation [3]. There are currently no randomized clinical trials in which a systematic evaluation of the effectiveness of surgical treatment would be carried out. However, A. J. Moss et al. [4] in 1971 reported the first successful use of left-sided sympathectomy in individual symptomatic patients, which were resistant to treatment with beta-blockers. The frequency of complications associated with surgery, an experienced surgeon should be around zero, and ptosis of the left eyelid – less than 3%. After SGB, symptoms of the disease are much weaker and the quality of life is much better, where after ICD implantation, complications can be much serious as inadequate therapy, electrode fractures, or infection. Today, in the leading centers of rhythm disturbances, percutaneous left-sided sympathectomy is the procedure of choice in patients with a malignant course of the disease, accompanied by repeated cardioverter-defibrillator shocks during recurrence of VT.

Case presentation

A 65 years old man in the intensive care unit (ICU), after suffering STEMI on April 18, 2018, there was a loss of consciousness on the painful attack. During the next 2 weeks, STEMI had been relapsed. On coronary angiography, a single vascular lesion of the left anterior descending artery was revealed. On echocardiography, mural thrombus with a size of 32x25 mm was detected on the left ventricle wall (LV). The ejection fraction of LV was 46.6% by the Simpson method. On the scale GRACE - 139 points – the average probability of death, on CRUSADE - 44 points – a high risk of ventricular bleeding. The hybrid operation was recommended: a coronary artery bypass grafting (CABG) with a thrombectomy and linear repairing aneurysm of LV. The patient was hospitalized for open-heart surgery on May 10, 2018. On May 13, 2018, after the toilet, a paroxysm of ventricular tachycardia developed with the transition to ventricular fibrillation, defibrillation was carried out by 200 J. From May 13 to May 15, he sustained from 16 polymorphic VT episodes and frequent premature ventricular complexes (PVCs) occurring from aneurysm location (ECG morphology shown in Figure 1), which all of the episodes were successfully terminated by electrical cardioversion. Amiodarone and lidocaine therapy was ineffective. The hybrid operation was performed on May 16, 2018. Despite this, the VT storm was repeated. Due to the poor patient's status and the presence of frequent VT storms, he was not found to eligible for an ICD implantation. It was explained, that continuous incidence of an ICD shock also known as "shock paradox" is associated with high mortality and device downgrading. Then, it was decided to carry out sympathetic denervation of the heart by ultrasound-guided blocking the stellate ganglion in the condition of the intensive care unit. The patients were placed in the supine position, a pillow placed under the shoulder and the neck extended and turned to the opposite side. The patient was given oxygen with a nasal cannula at a flow rate of 2l per minute. The procedure was started by placing the needle tip anterolateral to the longus colli muscle, deep to the prevertebral fascia in order to avoid spread along the carotid sheath, but superficial to the fascia

investing the longus colli muscle (to prevent injecting into the muscle). Identifying the correct fascial plane achieved with portable ultrasound guidance (IQ Butterfly), thus facilitating the caudal spread of the injectate to reach the stellate ganglion at the C7-T1 level (Figure 2). This allowed for a more effective and stable sympathetic block with the use of a small injective volume. As an injection, we firstly used 2%-5.0 ml of lidocaine. The efficacy was assessed as reducing the frequency of PVCs, which had previously been encountered more often. After identifying a negative Horner syndrome, the procedure was continued by injection of ethanol 96%, in quantity 5.0 ml for a lasting effect. The first procedure suppressed VT storm, completely. Thereafter the patient was stable on amiodarone infusion. During the next 6 months, only a few premature ventricular complexes other morphology were recorded on 24h Holter monitoring, neurological complications were not detected.

Discussion

We report the patient with severely depressed left ventricular function, ischemic etiology presenting with VT storm, which was resistant to conventional pharmacotherapy, consequently treated with stellate ganglion blocks. Nowadays, there is an increasing interest in the modulation of the autonomic nervous system (ANS) in the treatment of ventricular tachyarrhythmia [5-9]. The simplest and most commonly used method of ANS modulation is the administration of a b-blocker [5,7]. Despite their clinical efficacy, b-blockers have several limitations related to difficulties in reaching the target dose. Moreover, b-blockers affect only the noradrenaline-mediated neurotransmission, while their effect on other neurotransmitters remains unchanged. Thus, the techniques that modify autonomic system functions attract a great deal of interest. There are many reports on the effectiveness of surgical and percutaneous sympathetic denervation in patients with VT storm. One randomized clinical study reported its beneficial effect in patients after myocardial infarction [10]. Nevertheless, its usefulness as emergency therapy in patients with HF and VT storm is limited due to the patient’s hemodynamic status and low availability of skilled surgical teams in the condition of ICU[9]. On

the other hand, percutaneous SGB is a routinely performed procedure in chronic pain management, even on an outpatient basis. Furthermore, the implementation of SGB into the arsenal of antiarrhythmic treatment methods seems to be reasonable. However, its use is limited by the lack of randomized clinical studies or multicentre registries. Moreover, there is no established technique for SGB. Usually performing left SGB is preferred, although some papers report on bilateral or right-sided SGB. Since there is an asymmetry in the innervation of the heart, that means the left and right sympathetic nerves affect different areas of the heart and impose different functional effects as well, the optimal side of SGB may depend on the underlying disease, type of arrhythmia and its origin [9]. In the presented cases both left-sided SGB were effective. Although lidocaine had a beneficial effect lasted for less time, where ethanol has a persistent action in the second case. Moreover, in the recently published meta-analysis on SGB, bupivacaine, and ropivacaine were the most frequently used local anesthetics[8].

Conclusion

Percutaneous SGB should be considered as an emergency therapy at the bedside in ICU is feasible for patients who are suffering recurrent VT. This method used urgently and reduced life-threatening VT, when conservative and interventional methods were ineffective. A 96 % ethanol injection had a more lasting effect than lidocaine. Stellate ganglion block should be carried out by ultrasound guidance, to ameliorate the safety of the procedure, simultaneously direct visualization of vascular structures, soft tissue structures. Due to this, the risk of vascular and soft tissue damage may be minimized. There is an urgent need for further studies that will determine the value of SGB in emergency settings.

Learning objective:

1. Percutaneous stellate ganglion block should be considered as in patients who suffered from VT storm.
2. The ultrasound-guided technique is more safe and effective than other techniques.

3. Using ethanol as injection volume had a more strong beneficial effect than lidocaine.

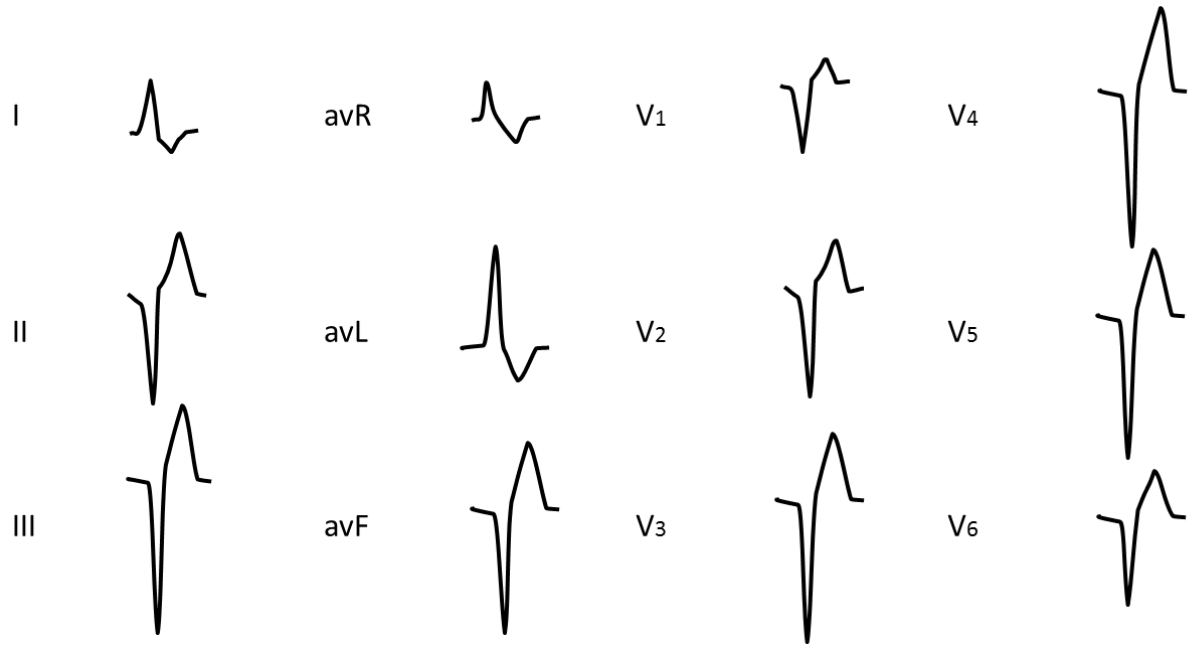

Figure 1. 12-lead ECG of PVC arising from the apex of LV.

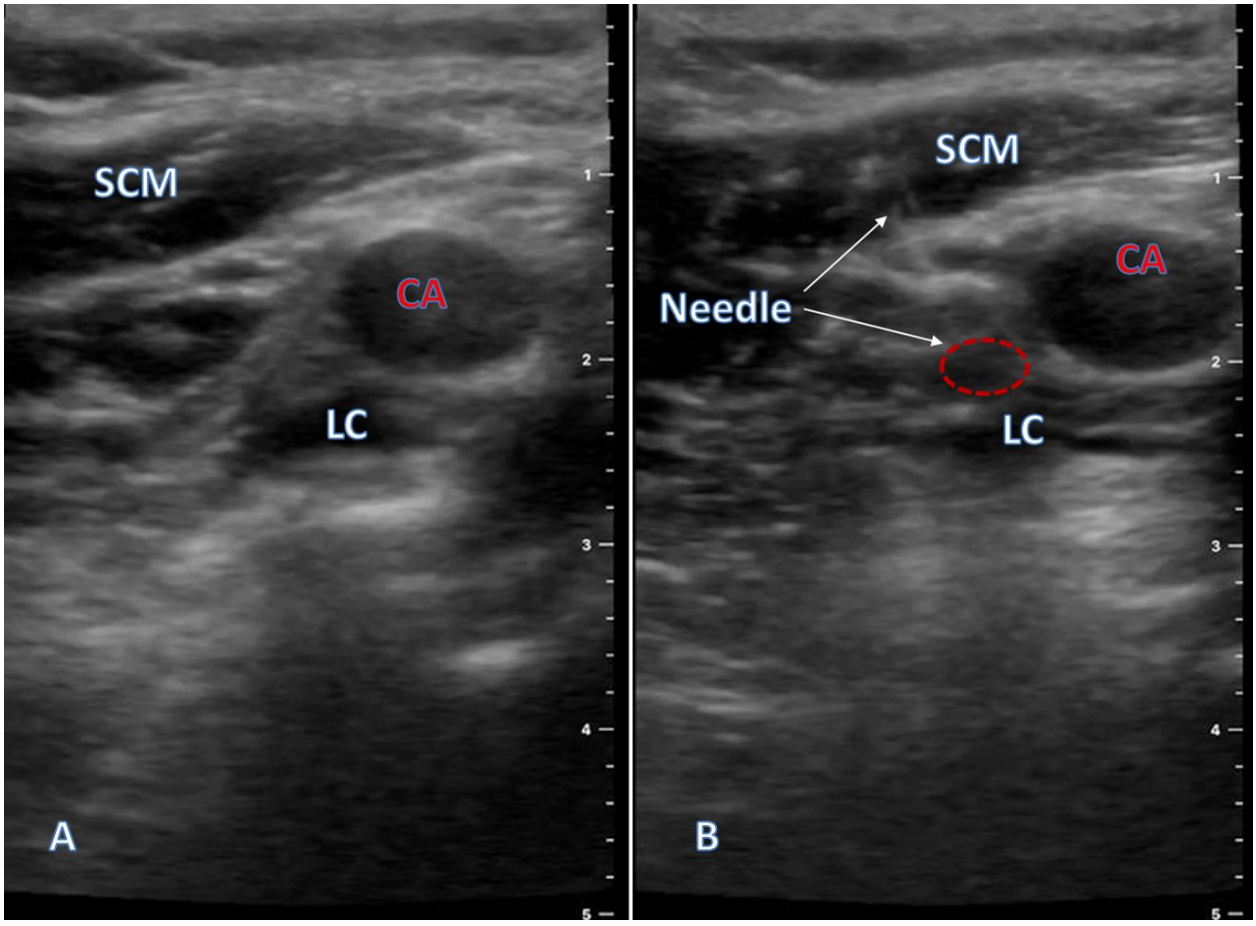

Figure 2. Transverse (A) and a real-time needle path (B) view at the C7 level. The dotted circular line indicates the area of the stellate ganglion. SCM – sternocleidomastoid muscle. LC – longus colli muscle. CA – carotid artery.

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