Intraoperative Ultrasound-Guided Left Stellate Ganglion Block for Postcardiotomy Cardiogenic Shock: A Shelter from the Storm

Postcardiotomy cardiogenic shock (PCCS) is a severe manifestation of low cardiac output syndrome (LCOS) that can follow heart surgery and progress to an inability to wean from cardiopulmonary bypass or persistent shock despite maximal pharmacological or even mechanical support. PCCS can be caused by inadequate intraoperative fluid management, bleeding, valve failure, post-bypass myocardial depression or ischemia, or vasoplegia, with a mortality rate that ranges from 24% to 52%.[1]

Relentless recurrences of ventricular arrhythmias (VAs), even in the form of electrical storms (ESs), can be an epiphenomenon or even the cause of PCCS and their intraoperative management remains challenging for the cardiac anesthesiologist. A systematic approach to this pathological situation requires understanding the etiology of PCCS and VA and their possible correlation and correcting all reversible conditions that may potentially contribute to the onset and/or recurrence of VA.

Hemodynamically unstable patients with shockable rhythms require urgent unsynchronized shock while, in the case of hemodynamically tolerated arrhythmias, intravenous (IV) antiarrhythmic drugs usually represent the first-line treatment. However, it should be noted that the increased sympathetic activity, despite ongoing general anesthesia, plays a key role and different techniques may allow an acute, transient, cardiac sympathetic block. These include percutaneous left stellate ganglion block (PLSGB).[2]

We report two cases of recurrent and refractory VA episodes in patients with PCCS treated with intraoperative ultrasound-guided PLSGB [Figure 1]. Both patients consented to the use of their clinical data for this report.

The first case concerns a 60-year-old patient with ischemic dilated cardiomyopathy and depressed preoperative left ventricular ejection fraction (<40%) undergoing coronary artery bypass grafting for right coronary artery aneurysm, with coronary arteries without significant stenosis. During cardiopulmonary bypass weaning, after Doppler ultrasound control of bypass flow that demonstrated the adequacy of grafting, PCCS with sustained ventricular tachycardias (VTs) occurred. Inotropic drugs were started (epinephrine infusion at 0.10 mcg/kg/minute) but, given the hemodynamic instability due to right heart failure and the recurrence of VTs refractory to antiarrhythmics drugs (Amiodarone 300 mg, Magnesium Sulfate 1g, Lidocaine 100 mg iv) and three internal direct current shock, ultrasound-guided PLSGB was performed. The procedure followed a stable sinus rhythm restoration even if the persistence of PCCS, despite electrical stabilization, made it necessary to implement mechanical cardiac support.

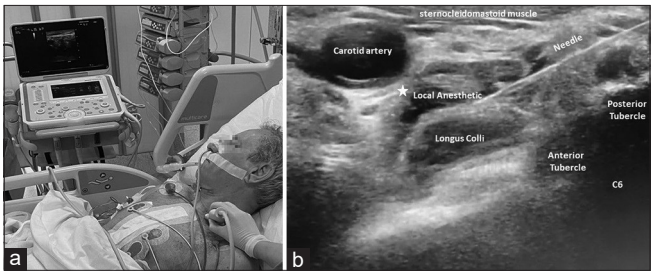

Figure 1: (a) Ultrasound-guidance was used to perform a left stellate ganglion block at the C6 level. (b) Initially, the interscalene plexus was identified using a high-frequency linear transducer. The transducer was then moved cranially and slightly laterally to visualize the entry of the C6 nerve root from the interscalene plexus to the foramen between the anterior and posterior tubercle. Subsequently, a 22-gauge needle was advanced using an in-plane technique. Local anesthetic was then injected under the prevertebral fascia and over the Longus Colli muscle. The star indicates the Stellate Ganglion's position

The second case concerns a 70-year-old patient with dilated valvular cardiomyopathy who underwent tricuspid valve repair by right mini-thoracotomy for massive tricuspid regurgitation. After weaning from cardiopulmonary bypass, the patient developed low cardiac output syndrome treated with inotropic drugs (epinephrine infusion at 0.12 mcg/kg/minute) accompanied by recurrent episodes of sustained ventricular fibrillations (VFs). Given the ineffectiveness of three external direct current shocks and antiarrhythmic medications (amiodarone 300 mg IV and lidocaine continuous infusion at 20 mcg/kg/min), ultrasound-guided PLSGB was performed that successfully prevented further ventricular arrhythmias, leading to hemodynamic stabilization.

In both cases, PLSGB has been performed after excluding the primary causes of refractory VAs: Myocardial ischemia, abnormal arterial blood gas, electrolyte disturbances, hypothermia, and aerial embolism.

The block was obtained locally by injecting a bolus of 7.5 mL of 2% lidocaine and 10 mL of 0.5% ropivacaine. No complications related to the block were observed. Due to the ongoing general anesthesia and muscular blockage, it was not possible to evaluate the development of Horner's syndrome that may occur as a sign of block of the upper part of the stellate ganglion (C8). However, it should be noted that the upper part of the

stellate ganglion, containing the ocular fibers, has no antiarrhythmic activity given that the cardiac fibers run in its lower part (T1).

PLSGB-related complications are usually rare and transient being left arm weakness due to transient paralysis of the left brachial plexus and voice hoarseness the more common. Local hematoma, brachial plexus injury, pneumothorax, hemothorax, chylothorax (thoracic duct injury), and esophageal perforation have also been very rarely reported.[3]

PLSGB was originally described and performed using an anterior blinded approach based on anatomical landmarks but, more recently, an increasing number of case reports describe the efficacy and increased safety of a lateral ultrasound-guided approach.[4] A recent study by Sanghai *et al*.[5] reported that ultrasound-guided continuous PLSGB achieved by the local placement of an epidural catheter is associated with a greater reduction in VA burden than single bolus ultrasound-guided PLSGB. However, in our experience, the PLSGB bolus has proven safe and effective even in the extreme scenario of PCCS accompanied by refractory ES, especially in a setting in which other sympathetic blockers, such as thoracic epidural anesthesia, could not be performed to achieve the same goal.

Authors' contributions

All authors contributed equally to the manuscript and read and approved the final version of the manuscript.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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Submitted: 03-Sep-2023 **Revised:** 22-Sep-2023
Accepted: 11-Oct-2023 **Published:** 12-Jan-2024

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Access this article online	
Quick Response Code:	Website: https://journals.lww.com/aoca
	DOI: 10.4103/aca.aca_124_23

How to cite this article: Toscano A, Giunta M, Capuano P, Balzani E, Salonia C, Balzano S, *et al*. Intraoperative ultrasound-guided left stellate ganglion block for postcardiotomy cardiogenic shock: A shelter from the storm. Ann Card Anaesth 2024;27:93-4.