| Title | Experience managing pain associated with supraclavicular nerves compressed by a cardiac implantable electrical device, diagnosed by the local nerve block |
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| Citation | Journal of Arrhythmia, 34(1):84-86 |
| Issue date | 2018-02 |
| Resource Type | Journal Article / 学術雑誌論文 |
| Resource Version | publisher |
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| DOI | 10.1002/joa3.12013 |
| JaLCDOI | |
| URL | http://www.lib.kobe-u.ac.jp/handle_kernel/90004690 |
Experience managing pain associated with supraclavicular nerves compressed by a cardiac implantable electrical device, diagnosed by the local nerve block

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Abstract
A 72-year-old man with ischemic cardiomyopathy was referred to undergo an implantation of a cardiac implantable electrical device (CIED). A pocket was created subcutaneously on the left anterior chest. After the operation, he complained of severe pain irradiating to his left posterior shoulder. The local anesthetic nerve block by a local infusion of mepivacaine revealed the pain was associated with the supraclavicular nerve. We re-created the pocket and shifted the generator toward the inner side, and the irradiating pain vanished. A local anesthetic supraclavicular nerve block is an important option for the diagnosis of pain after a CIED implantation.

KEYWORDS
CIED implantation, complication, supraclavicular nerve

1 | INTRODUCTION
Complications associated with cardiac implantable electrical device (CIED) implantations related to the supraclavicular nerve are very rare. We experienced a case of a patient with pain associated with the supraclavicular nerve compressed by a CIED generator.

2 | CASE PRESENTATION
A 72-year-old man with ischemic cardiomyopathy, severe left ventricle systolic dysfunction (ejection fraction = 31%), a wide QRS duration (146 ms), NYHA class 3 (on optimal medical management), and monomorphic ventricular tachycardia with presyncope was referred to undergo an implantation of a CRTD.

The pocket was created subcutaneously on the left anterior chest. The shock lead was inserted into the right ventricular apex by a cut-down method of the left cephalic vein, and the right atrium lead and left ventricular lead were inserted by an extrathoracic puncture of the subclavian vein.

After the operation, no hematoma or symptoms of infection were observed. However, he complained of severe pain irradiating to his left posterior shoulder, so flexion and abduction of the left shoulder were severely limited. Same as the patients implanted CIED, we considered the pain was simply associated with the skin cutting or the contracture of the shoulder joint. Re-operation to shift the generator was thought to be one of the choices; however, the early re-operation has been reported to increase the risk of the CIED infection. So, he was treated with noninvasively and encouraged to move the shoulder joint positively to prevent the worsening of contracture. However, his pain could not get better for 6 months after the CIED implantation.

We consulted with an anesthesiologist, and he estimated that the culprit nerve was the supraclavicular nerve (arising from the third and fourth cervical nerves; C3, C4) or intercostal nerve (arising from the first to third thoracic nerves; T1 to T3) in terms of the...
dermatome distribution of the anterior chest. Furthermore, he also suspected the brachial plexus (C5–C8, T1) was involved, as the CIED leads were inserted through the subclavian vein, which is near the brachial plexus. And he also suspected that the pain was caused by the direct compression of the deltoid muscle, the shoulder joint and the clavicle, which are mainly innervated by the axillary and suprascapular nerves that originate from C5 and C6.

First, he underwent a pinpoint anesthetic block of the proximal C4 by an infusion of low-dose mepivacaine (2%, 1.5 mL) by a deep cervical plexus block pinpoint, and the pain vanished dramatically. Second, he underwent a local anesthetic block of the left brachial plexus by a supraclavicular approach (1% mepivacaine 10 mL), but the pain did not vanish. Third, he underwent a pinpoint anesthetic block of the proximal C5 and C6 (1% mepivacaine 1.5 mL for each), but the pain remained.

From the above results, we made a diagnosis of compression of the supraclavicular nerve by the generator. When the generator was shifted toward inner side from the skin surface manually, the pain disappeared. So we considered that the supraclavicular nerve was compressed around the cephalic vein or the shoulder joint rather than the center of the pectoralis major.

We planned the re-operation without the use of sedation, to confirm the elimination of the pain by the shift of the generator. We re-created the pocket and shifted the generator toward the inner side, and the pain disappeared. So we judged the pain was not associated with the leads of the CIED, and we did not remove them (Figure 1). After the operation, the patient became free from irradiating pain.

3 | DISCUSSION

The supraclavicular nerves arise from C3 and C4. These nerves emerge as a common trunk beneath the posterior border of the sternocleidomastoid muscle. As it approaches the clavicle, the common trunk of these nerves divides into three groups consisting of descending branches (medial, intermediate, and lateral supraclavicular nerves). These nerves run over the clavicle and supply the skin as far as the midline, then over the pectoralis major and deltoid muscles, and then the upper and posterior parts of the shoulder (Figure 2).

The "entrapment syndrome" is known as pain associated with the supraclavicular nerves. In some people (1 to 6.6%), there are tunnels and grooves for the supraclavicular nerves within the clavicle, and the supraclavicular nerves are compressed by the tunnel as a result of overuse of the shoulder joint in athletes or workers, and it causes pain in the neck, clavicular, thorax, and shoulder region. In our case, the pain was associated with the supraclavicular nerve being compressed by the CIED generator. That might be the same mechanism as that with the “entrapment syndrome.”

Anterior chest wall numbness due to injury of the supraclavicular nerves is a common complication after surgery for a plate fixation for displaced clavicle fractures. It is reported that mini open plating (skin incision length: mean 6.1 ± 1.2 cm) can reduce the anterior

FIGURE 1  (Left panel) A chest X-ray just after the implantation of the CRTD device. (Right panel) A X-ray after the re-operation to shift the generator toward the inner side.

FIGURE 2  An anatomical illustration of the supraclavicular nerve.
chest wall numbness in comparison with the conventional open plating (skin incision length: mean 9.4 ± 1.8 cm).\(^2\) In the case of a CIED implantation, the length of the skin incision is relatively small. That might be one of the reasons why complications associated the supraclavicular nerves are rare with CIED implantations.

In our case, the incision was relatively long, to expose the left cephalic vein for the lead insertion, but it was within the bounds of common sense (about 6 cm). The relationship between the complications and relatively long incision was unclear.

In our case, his generator might be positioned slightly lateral than an appropriate position. Because the compression of the supraclavicular nerves between the CIED generator and the humeral head might be induced by the shoulder joint movement, to implant a CIED generator just on the chest wall may prevent these phenomenon. However, the supraclavicular nerves also run on the pectoralis major broadly, so we have thought that it is hard to completely prevent the injury to the supraclavicular nerves.

We experienced a very rare case with pain associated with supraclavicular nerves compressed by a CIED generator. A local anesthetic supraclavicular nerve block is an important option for the diagnosis of pain after a CIED implantation.

ACKNOWLEDGEMENTS

We would like to thank Mr. John Martin for his linguistic assistance.

CONFLICT OF INTEREST

Authors declare no Conflict of Interests for this article.

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How to cite this article: Imada H, Fukuzawa K, Kiuchi K, Hirata K-I, Sato H. Experience managing pain associated with supraclavicular nerves compressed by a cardiac implantable electrical device, diagnosed by the local nerve block. J Arrhythmia. 2018;34:84–86. https://doi.org/10.1002/joa3.12013