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PROFESSIONAL PAPER

Technique presentation: The combination of Pectoralis and Serratus Plane Nerve Blocks for cardiac implantable devices

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Cardiac resynchronization therapy devices, implantable cardioverter defibrillators, and pacemakers are used to treat advanced systolic heart failure, ventricular tachyarrhythmias, and bradyarrhythmia. Over the past ten years, there has been a notable rise in the number of cardiac implanted electronic device implants because of mounting evidence of better survival and quality of life among specific patient populations. Appropriate analgesia and sedation throughout the implantation procedure is crucial for the patient's stability. This paper aims to describe the advantages of both interpectoral plane block (PECS I) and interpecto-seratus plane block (PECS II) for the implantation of cardiac devices.

Combining PECS I and PECS II blocks provides advantages for the thoracic wall procedures. While the PECS I block anesthetizes the medial and lateral pectoral nerves, PECS II extends coverage to upper intercostal nerves (T2-T7), as well as the long thoracic and thoracodorsal nerves, covering areas that are not anesthetize adequately by PECS I alone. Minimizing the need for opioids, leading to fewer opioid related side effects contributing to shorter recovery time and nonetheless creating less discomfort for the patient.

This combined regional technique offers comfort to the patient due to its sole puncture needed for performance and by offering an extensive anesthesia at the site of the procedure.

Keywords: PECS, regional anesthesia, cardiac implantable devices

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Introduction

Cardiac resynchronization therapy devices, implantable cardioverter defibrillators (ICDs), and pacemakers are used to treat advanced systolic heart failure, ventricular tachyarrhythmias, and bradyarrhythmias [1]. Over the past decade years, there has been a notable rise in the number of cardiac implanted electronic devices (CIED) implants due to mounting evidence of better survival and quality of life among specific patient populations [2]. Appropriate analgesia and sedation throughout the implantation procedure are crucial for the patient's stability. The anesthesia options for these types of patients are general anesthesia, lidocaine infiltration during the procedure, as well as the possibility of using regional anesthesia techniques. Patients who need CIED implantation are typically high-risk candidates for general anesthesia. Peripheral nerve block procedures may be performed as a means of avoiding the potential side effects of general anesthesia, such as hemodynamic instability, respiratory and neurologic complications [3]. Lidocaine infiltration can lead to Local anesthetic systemic toxicity, a serious complication manifested trough hemodynamic and neurological complication[4]. Many regional anesthesia techniques are described, out of which the pectoral plane block and the interpectoserat block are the most used. Pectoral plane blocks are reliable regional anesthesia techniques that provide efficient anesthesia and analgesia throughout and after the implantation procedure [5,6]. In this paper, we describe the usage of combined interpectoral plane block (PECS I) and interpecto-seratus plane block (PECS II) for the implantation of cardiac devices.

Cardiac device implantation technique

The implantation of cardiac devices involves minor surgery techniques. A five to six cm incision is made under the clavicle, on the medio clavicular line, followed by preparation of the subcutaneous tissue up to the pectoral fascia, followed by the dissection and preparation of the tissues to create the pocket for the implantable device. The subclavian vein is dissected and prepared after which the device is implanted as seen in Figure 1.

The patient's vital signs are monitored throughout the entire procedure to ensure cardiorespiratory stability.

Combined PECS I and PECS II Regional anesthesia technique for cardiac device implantation

The regional block is performed with the patient in the supine position, with their arm by their side. A liner ultrasound probe is placed on the anterior chest wall, medial to the coracoid process, in parasagittal orientation.

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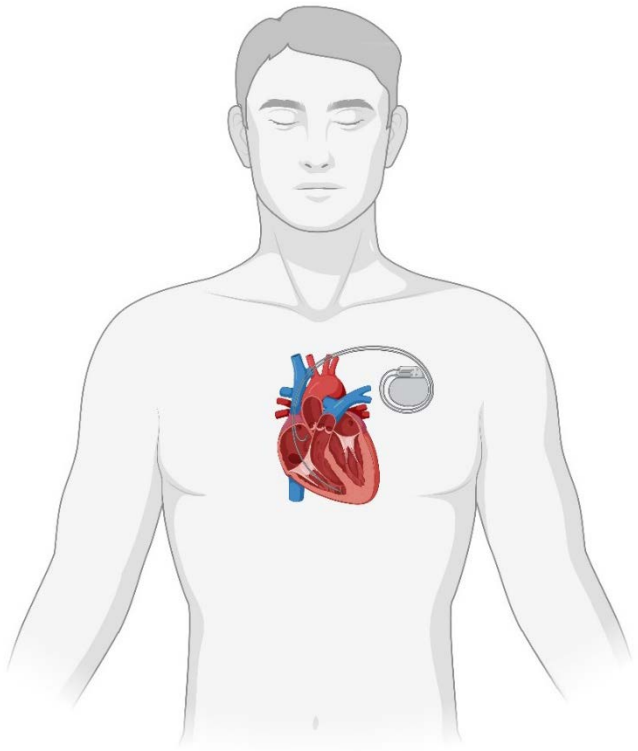

Fig. 1. Cardiac device position (BioRender)

While the anesthetist usually stands at the head of the bed, we used a modified position where the anesthetist stands on the left side of the patient. In this ultrasonographic window, the typical sono-anatomy is associated with the infraclavicular brachial plexus, including pectoralis major and pectoralis minor muscles, and the axillary artery. Tilting of the probe and placing it in the delta-pectoral grove brings the chest wall into view underneath the axillary vessels. At the same time counting the ribs is a crucial move for the success of this plane block. Therefore, the rib placed directly underneath the axillary vein is the second rib. If the probe is translated inferiorly and laterally, the third rib is met. Here the fascial plane between the pectoral muscle can be evaluated, being the target for the first infiltration (PECS I) (Figure 2). From this point the probe is further translated inferiorly and laterally, until the forth rib is visualized. At this point serratus anterior split of the muscle appears overlying the rib underneath pectoralis minor muscle (Figure 3). The fascial plane between these two muscles is the target for the PECS II block. Here we make the first local anesthetic administration. Supplementary caution must be taken, given that the pleura is on the other side of the rib. Needle puncture is performed 1 cm from the caudal side of the probe, passing through the pectoralis major and pectoralis minor muscles, entering the fascial plane between the pectoralis minor muscle and serratus anterior muscle. After negative aspiration, we administered a volume between 15 and 20 ml of local anesthetic. The needle is retracted and between the fascial plane of the pectoralis major and pectoralis minor muscles, we administer a second dose of 10 ml local anesthetic for the PECS I fascial block.

Discussion

Cardiac devices are implanted using local anesthesia, and short-acting or long-acting local anesthetics. This method often requires multiple applications of the local anesthetic, which not only increases the dosage but also causes discomfort to the patient. Furthermore, using local anesthetic infusion may have a negative impact on the patient, be-

Fig. 2. Interpectoral plane block (PECS I) (personal archive). Legend: PM: pectoralis major muscle; pm: pectoralis minor muscle

Fig. 3. Interpecto-seratus nerve block (PECS II) (personal archive).
Legend: PM: pectoralis major muscle; pm: pectoralis minor muscle; sam: serratus anterior muscle

cause the excessive volume used during the procedure leads to stress and inadequate wound healing due to local anesthetic intoxication [7]. The potential complications of lidocaine infiltration are local anesthetic systemic toxicity manifested primarily throughout nervous system complications, such as seizures, loss of consciousness, and coma and cardiovascular system complications. The need for more anesthetic is usually decided by the patient's response to the pain caused by the surgical procedure. However, if the patient is anxious or uncooperative, the procedure must be performed under general anesthesia. This approach can be dangerous as it may lead to hemodynamic instability [8].

Pectoral nerve blocks were introduced in 2011 by Blanco, to ensure effective analgesia after breast surgery, being a suitable alternative for thoracic epidural or paravertebral plane block, which implies substantial complications [9]. Although the primary purpose of the block was to provide analgesia after breast surgery, several case reports describe the use of PECS block for analgesia following thoracotomy and rib fractures [10].

Kilin et al [11] published a pilot study involving 30 patients who underwent cardiac device implantation with PECS II block. Their work has promising results in the applicability of this regional analgesia technique.

Tsai et al describes a thoracic paravertebral block for implantable cardioverter-defibrillator in a 51-year-old patient with hypertension, asthma and human immunodeficiency virus infection. The authors emphasize that although the paravertebral block was useful for this patient, it presents numerous risks, such as pneumothorax, epidural or subarachnoid anesthesia, pulmonary injury, vascular puncture and hematoma [12,13].

Combining PECS I and PECS II blocks provides several advantages, for various thoracic wall procedures. While the PECS I block anesthetizes the medial and lateral pectoral nerves, PECS II extends coverage to upper intercostal nerves (T2-T7), as well as the long thoracic and thoracodorsal nerves, covering areas that are not anesthetize adequately by PECS I alone. Minimizing the need for opioids reduces opioid-related side effects, promotes faster recovery, and ensures greater patient comfort. This is achieved using a combination of blocks that require only a single skin puncture.

The use of both pectoral plane blocks for the implantation of cardiac devices provides similar analgesia compared to more invasive blocks suck as paravertebral block, with a lower risk for complications, such as pneumothorax, epidural or spinal spread of the anesthetic, making it a safer choice. Under ultrasound guidance, the pleura and the large blood vessels are visible throughout the procedure increasing the safety of the procedure by offering a real time image of the anatomical structures [5].

Conclusion

The combination of the PECS blocks is a suitable option for high-quality anesthesia and analgesia for cardiac device implantation procedure. This combined regional technique offers comfort to the patient due to its sole puncture needed for performance and by offering an extensive anesthesia at the site of the procedure.

Authors' contribution

MB (Conceptualization, Investigation, Project administrator, Validation, Visualization, Writing – original draft)
FL (Supervision, Writing – review & editing)
AL (Conceptualization, Supervision, Writing – review & editing)

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Conflict of interest

None to declare.

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References

1. Hussein AA, Wilkoff BL. Cardiac implantable electronic device therapy in heart failure. Circ Res. 2019;124:1584-1597
2. Goldberger Z, Lampert R. Implantable cardioverter-defibrillators: expanding indications and technologies. JAMA 2006;295:809–818
3. Harris M, Chung F. Complications of general anesthesia. Clin Plast Surg. 2013 Oct;40(4):503-13.
4. Liew J, Lundblad J, Obley A. Local Anesthetic Systemic Toxicity Complicating Thyroid Biopsy. Cureus. 2017 Dec 16;9(12):e1955.
5. Mavarez AC, Ripat CI, Suarez MR. Pectoralis plane block for pacemaker insertion: a successful primary anesthetic. Front Surg. 2019;6:64
6. Metinyurt HF, Sugur T, Kavakli AS, Cagirci G. Clavipectoral fascial plane block for implantable cardioverter defibrillator implantation. J Clin Anesth. 2021 Aug:71:110197
7. Looi KL, Lee AS, Cole K, Agarwal S, Heck PM, Begley DA, Grace AA, Virdee M, Fynn SP. Conscious sedation, and analgesia use in cardiac device implantation. Int J Cardiol 2013; 168:561–563
8. Butterworth JF, Models, and mechanisms of local anesthetic cardiac toxicity: a review. Reg Anesth Pain Med 2010; 35:167–176
9. Blanco R. The 'pecs block': a novel technique for providing analgesia after breast surgery. Anaesthesia. 2011;66:847-848
10. Kunhabdull NP, Agarwal A, Gaur A, Gautam S, Gupta R, Agarwal A. Serratus Anterior Plane Block for Multiple Rib Fractures. Pain Physician 2014; 17:651-653
11. Kilin M, Kavakli AS, Karaveli A, Sugur T, Kus G, Cagirci G, Arslan S. PECS II block for cardiac implantable electronic device insertion: A pilot study. Pacing Clin Electrophysiol. 2023 Oct;46(10):1251-1257
12. Tsai T, Rodriguez-Diaz C, Deschner B, Thomas K, Wasnick JD. Thoracic paravertebral block for implantable cardioverter-defibrillator and laser lead extraction. J Clin Anesth. 2008 Aug;20(5):379-382. doi: 10.1016/j.jclinane.2008.01.012. PMID: 18761249
13. Naja Z, Lönnqvist PA. Somatic paravertebral nerve blockade. Incidence of failed block and complications. Anaesthesia. 2001 Dec;56(12):1184-8. doi: 10.1046/j.1365-2044.2001.02084-2.x.