

# Regional anaesthesia techniques for placement of subcutaneous implantable cardioverter defibrillators

## Introduction

Subcutaneous implantable cardioverter-defibrillators are used in the detection and defibrillation of malignant ventricular arrhythmias. Insertion of a subcutaneous implantable cardioverter-defibrillator device has been described using local anaesthetic infiltration with monitored anaesthesia care or under general anaesthesia.

This article presents three patients where the primary mode of anaesthesia for subcutaneous implantable cardioverter-defibrillator insertion was ultrasound-guided regional anaesthesia techniques, including paravertebral, pectoralis, serratus anterior and transversus thoracic blocks. Interfascial plane blocks provide satisfactory perioperative and postoperative analgesia and may increase the number of patients being considered for subcutaneous implantable cardioverter-defibrillator insertion without the need for general anaesthesia.

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## Case report 1

A 28-year-old woman with a history of prolonged QT syndrome was admitted after an unwitnessed collapse. Electrocardiogram confirmed a QTc interval of 457 ms. Transthoracic echocardiogram found borderline left ventricular hypertrophy with prominent trabeculation at the apex.

A left-sided serratus anterior block was administered using 20 ml of 0.25% levobupivacaine, and a transversus thoracic block using 10 ml of 0.25% levobupivacaine. Both blocks were performed using the linear probe of a Sonosite ultrasound machine with a 50 mm 20G Stimuplex needle. Negative aspiration was performed before local anaesthetic administration.

The subcutaneous implantable defibrillator was inserted into a pocket made deep to the latissimus dorsi via a left axillary incision. A second incision to the left of the xyphoid process allowed for lead tunneling and fixation. The cardioverter device was then tested on induced ventricular fibrillation. Intraoperative sedation was provided with 200 µg fentanyl and 13 mg midazolam. Postoperatively the patient was prescribed oral analgesics before discharge.

## Case report 2

A 49-year-old man with a history of substance abuse was admitted to hospital after an out of hospital cardiac arrest. Return of spontaneous circulation was achieved after approximately 15 minutes of bystander and paramedic cardiopulmonary resuscitation.

A coronary angiogram revealed unobstructed coronary arteries. A transthoracic echocardiogram showed a left ventricular ejection fraction of 37%, basal hypokinesis and apical akinesis.

A subcutaneous implantable cardioverter-defibrillator was inserted, using ultrasound guidance, with a left-sided pectoralis block, serratus anterior block and transversus thoracic block performed using 30 ml 0.25% bupivacaine.

Intraoperative sedation was provided with 125 µg fentanyl and 8 mg midazolam. Monitoring was continued throughout the 80-minute procedure. The patient reported no discomfort during insertion or cardioversion, and no significant changes in blood pressure or heart rate were noted during the operation. Postoperative analgesia was provided with oral paracetamol.

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**Case report 3**

A 60-year-old man with a history of apical hypertrophic cardiomyopathy presented with refractory symptomatic atrial fibrillation.

Investigations including cardiac magnetic resonance imaging found areas of late enhancement after gadolinium, highly suspicious for fibrosis. On the basis of these findings the patient was deemed at an increased risk of sudden cardiac death.

All therapeutic options were discussed with the patient and insertion of a subcutaneous implantable cardioverter-defibrillator was recommended.

A left-sided transversus thoracic block was performed with 10ml 0.25% levobupivacaine chosen in an effort to provide lasting postoperative analgesia, along with a left-sided paravertebral block at the level of T4 and T5 with 10ml (5ml in each level) of 0.5% levobupivacaine.

The subcutaneous implantable cardioverter-defibrillator pulse generator was inserted into a subcutaneous pocket created deep to the latissimus dorsi via a left axillary incision. A second incision was made to the left of the xiphoid process to facilitate tunneling the defibrillator lead into the parasternal subcutaneous space.

Sedation was provided with 75µg fentanyl and 4mg midazolam, with monitoring ongoing throughout the 90-minute procedure. The patient was in no distress during the procedure and remained haemodynamically stable. Postoperative analgesia was provided with oral paracetamol.

**Discussion**

Implantable cardioverter defibrillators are used to prevent sudden cardiac death (Priori et al, 2015). Transvenous implantable cardioverter defibrillator systems contain leads travelling endovascularly to the heart. Lead-associated complications include pneumothorax, cardiac tamponade and endocarditis. A subcutaneous implantable cardioverter-defibrillator system was developed to overcome such complications (Bardy et al, 2010; Cappelli et al, 2014). The subcutaneous implantable cardioverter-defibrillator comprises a pulse generator (placed at the fifth intercostal space in the left mid-axillary line) and a single lead tunneled to the sternum; both are placed in subcutaneous tissue (Chang et al, 2014).

There are currently no guidelines for the anaesthetic management of implantation of subcutaneous implantable cardioverter-defibrillators. General anaesthesia, monitored anaesthesia care and regional anaesthesia techniques have been described (Ueshima and Otake, 2016; Gold et al, 2017).

A multicentre survey of 429 implantable cardioverter defibrillator implantations was carried out. In this just 86 had a subcutaneous implantable cardioverter-defibrillator implanted, with 72% (n=53) of these inserted under general anaesthetic (Lenarzyk et al, 2018).

The high pre- and postoperative opioid-based analgesic requirements, generally needed for 5 days after insertion of a subcutaneous implantable cardioverter-defibrillator under general anaesthetic, may limit their more widespread use (Essandoh et al, 2018; Lenarzyk et al, 2018; Miller et al, 2018).

Ultrasound-guided regional anaesthesia techniques have been used successfully in patients undergoing anterolateral chest wall procedures (Blanco, 2011). The pectoralis I and II block the pectoral and intercostal nerves, providing analgesia for the anterior chest wall. Serratus anterior and transversus thoracic blocks anaesthetise the long thoracic and thoracodorsal nerves, providing analgesia to the anterolateral chest wall and parasternal area (Lenarzyk et al, 2018). For further information on technique please see: <https://www.youtube.com/watch?v=FBcGtImnlnU>

This report outlines three cases in which ultrasound-guided paravertebral, pectoralis, serratus anterior and transversus thoracic blocks were used as the primary method of anaesthesia for insertion of subcutaneous implantable cardioverter-defibrillators, providing satisfactory peri-procedural analgesia.

## Learning points

- Ultrasound-guided interfascial plane regional anaesthesia techniques should be considered for the insertion of subcutaneous implantable cardioverter-defibrillators.
- Postoperative analgesic requirements for this procedure vary from patient to patient, but may be significantly reduced using regional anaesthesia techniques.

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