

# Single-shot pectoral plane (PECs I and PECs II) blocks versus continuous local anaesthetic infusion analgesia or both after non-ambulatory breast-cancer surgery: a prospective, randomised, double-blind trial

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## Abstract

**Background:** Pectoral plane blocks (PECs) are increasingly used in analgesia for patients undergoing breast surgery, and were recently found to be at least equivalent to single-shot paravertebral anaesthesia. However, there are no data comparing PECs with the popular practice of continuous local anaesthetic wound infusion (LA infusion) analgesia for breast surgery. Therefore, we compared the efficacy and safety of PECs blocks with LA infusion, or a combination of both in patients undergoing non-ambulatory breast-cancer surgery.

**Methods:** This single-centre, prospective, randomised, double-blind trial analysed 45 women to receive either PECs blocks [levobupivacaine 0.25%, 10 ml PECs I and levobupivacaine 0.25%, 20 ml PECs II (PECs group); LA infusion catheter (levobupivacaine 0.1% at 10 ml h<sup>-1</sup> for 24 h (LA infusion group); or both (PECs and LA infusion)]. The primary outcome measure was area under the curve of the pain verbal rating score whilst moving vs time (AUC) over 24 h. Secondary outcomes included total opioid consumption at 24 h.

**Results:** AUC moving was mean (SD) 71 (34) mm h<sup>-1</sup> vs 58 (41) vs 23 (20) in PECs, LA infusion, and both, respectively;  $P=0.002$ . AUC at rest was also significantly lower in patients receiving both. The total 24 h opioid consumption [median (25–75%)] was 14 mg (9–26) vs 11 (8–24) vs 9 (5–11);  $P=0.4$ . No adverse events were observed.

**Conclusions:** The combination of both pre-incisional PECs blocks and postoperative LA infusion provides better analgesia over 24 h than either technique alone after non-ambulatory breast-cancer surgery.

**Clinical trial registration:** NCT 03024697.

**Keywords:** breast surgery; local anaesthetic infusion; mastectomy; (PECs) pectoral plane block

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### Editor's key points

- Breast-cancer surgery requires careful control of post-operative pain for immediate and long-term benefit.
- Regional analgesia, with reduced opioid requirements, may confer some benefits in this patient group.
- This double-blind randomised controlled trial evaluates two different regional anaesthetic techniques alone and in combination.
- Single-shot pectoral plane blocks, together with local anaesthetic wound infusion, provided optimal analgesia.
- This promising result would support the need for further, larger studies in this area.

Breast surgery is associated with significant postoperative pain in a vulnerable patient group.<sup>1</sup> A number of analgesic strategies exist as part of a multimodal framework. Opioids are commonly used, although issues with their use are widely documented. Regional anaesthetic techniques are prevalent in clinical practice. Thoracic paravertebral blocks (TPVBs), given as single shot, and continuous local anaesthetic wound infusion (LA infusion) catheters are more effective than placebo, and reduce postoperative pain and opioid consumption.<sup>2–8</sup>

Pectoral plane (PECs) blocks are recently described. PECs I is deposition of local anaesthetic between pectoralis major and minor muscles at the third rib level.<sup>9</sup> PECs II is an extension of PECs I, with placement of additional local anaesthetic between pectoralis minor and serratus anterior muscles.<sup>10</sup> Single-shot PECs blocks are superior to placebo<sup>11,12</sup> and recently also at least equivalent to single-shot TPVB in a small, single (investigator)-blind trial,<sup>13,14</sup> although both PECs and TPVB gave good early (0–12 h) analgesia.

LA infusion analgesia provides better late (12–24 h) analgesia than the single-shot TPVB.<sup>8</sup> Whilst single-shot PECs blocks have been rapidly adopted into clinical practice, it is not yet known if they provide adequate late analgesia when compared with available alternatives, or if a combined PECs and LA infusion approach would lead to improved results. There is a dearth of methodologically high-quality clinical trials evaluating either of these techniques in practice. Therefore, we aimed to compare the analgesic efficacy of single-shot PECs block vs LA infusion vs a combination of both PECs block and LA infusion, in women undergoing non-ambulatory breast surgery.

## Methods

The Mater Misericordiae University Hospital's Institutional Review Board (IRB) approved this study; reference number 1/378/1840, dated December 21, 2016. It was registered at [clinicaltrials.gov](http://clinicaltrials.gov); reference number NCT03024697, dated February 15, 2017. Forty-five ASA I–III female patients aged 18 yr or older, undergoing non-ambulatory breast-cancer surgery under general anaesthesia between January and May 2017, were included. All participants provided informed written consent.

Non-ambulatory breast-cancer surgery encompassed wide local excision (WLE) with lymph-node resection, simple mastectomy, and mastectomy with sentinel lymph-node resection. Those undergoing latissimus dorsi or deep inferior epigastric perforator flap reconstruction were excluded.

Patients with chronic-pain syndromes, local anaesthetic allergy, contraindication to simple analgesics, local infection over the proposed block site, coagulopathy, or comorbid conditions precluding the provision of informed consent were excluded. All patients were day-of-surgery admission and attended a preoperative anaesthetic assessment clinic.

The patients were allocated into three groups using computer-generated randomisation, with the study number and group allocation concealed in sealed envelopes. Blocked randomisation in groups of nine was applied, giving similar numbers in each group as the study progressed. Groups were named 'PECs', 'local anaesthetic infusion (LA infusion)', and 'both (PECs and LA infusion)', which were evenly distributed to opaque envelopes numbered 1–45 in accordance with randomisation. The randomisation key was held by an independent party and was not used to reveal participant group allocations until data analysis commenced. PECs patients received the blocks and a sham wound-infiltration catheter. LA infusion patients received a continuous LA infusion catheter. PECs and LA infusion patients received a combination of techniques, without the initial local anaesthetic bolus via the wound infusion catheter. PECs blocks were performed whilst patients were under general anaesthesia, before the commencement of surgery. The operative surgeon sited wound infusion catheters during skin closure at the end of surgery.

The patients were induced with fentanyl 1–2  $\mu\text{g kg}^{-1}$ , followed by propofol titrated to the absence of verbal response. Anaesthesia was maintained using an oxygen, air, and sevoflurane combination. Airway management and lung-ventilation strategies were at the discretion of the supervising anaesthetist. The patients received a standard intraoperative analgesic regimen of paracetamol 1 g and dexamethasone 50 mg i.v., with rescue morphine as deemed necessary. Combination anti-emetics, including ondansetron 0.1–0.15 mg  $\text{kg}^{-1}$  i.v., dexamethasone 0.1–0.2 mg  $\text{kg}^{-1}$  i.v., or droperidol 0.01–0.015 mg  $\text{kg}^{-1}$  i.v., were administered according to patient risk factors, with dexamethasone given to all patients regardless of risk of postoperative nausea and vomiting (PONV). Intraoperative management was otherwise left to the discretion of the supervising anaesthetist. Routine monitoring was used in accordance with the Association of Anaesthetists of Great Britain and Ireland guidelines.<sup>15</sup> An electronic anaesthetic record was used to document physiological parameters. Perioperative events, such as induction of anaesthesia, initial skin incision, and end of surgery, were annotated on the record.

PECs blocks were performed on the side of surgery, using the ultrasound-guided technique described by Blanco<sup>9</sup> and Blanco and colleagues.<sup>10</sup> The patient was placed in the supine, head-up, position with the arm abducted. The skin was prepared with chlorhexidine gluconate 2%/isopropyl alcohol 70% (ChlorPrep; Becton Dickinson, New Jersey, NJ, USA). They were performed with a 22-gauge echogenic needle (Ultraplex 360 cannula; B. Braun, Herten, Germany; 50–80 mm), using the same ultrasound machine (SonoSite Edge; SonoSite, Inc., Bothell, WA, USA) and transducer (SonoSite HFL 50x; SonoSite, Inc.). The ultrasound probe was placed inferolaterally at the mid-clavicular level. The axillary artery and vein were identified, and the probe moved laterally until pectoralis major, pectoralis minor, and serratus anterior muscles were located at the level of the third rib. A needle in-plane approach was taken until the needle tip was positioned in the plane between pectoralis major and minor muscles, and levobupivacaine 0.25%, 10 ml was injected. The needle was advanced until it

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