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Pectoral nerve block1 versus modified pectoral nerve block2 for postoperative pain relief in patients undergoing modified radical mastectomy: a randomized clinical trial†

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Abstract

Background. Pectoral nerve block1 (PEC1) given between pectoralis major and minor, and modified pectoral nerve block2 (mPEC2) performed between pectoralis minor and serratus anterior, can provide continuous analgesia after modified radical mastectomy (MRM) when catheters are placed before skin closure. This study was designed to compare PEC1 and mPEC2 block for providing postoperative pain relief after MRM.

Methods. Sixty-two physically fit patients undergoing MRM were assigned into two groups (Group PEC1, n=31 and Group mPEC2, n=31). Before wound closure, epidural catheter was placed in the group designated muscle plane and 30ml of 0.25% bupivacaine was injected through the catheter after wound closure. Bupivacaine 15ml of 0.25% top up was given on patient's demand or whenever visual analogue scale (VAS) score was>4. Time for first analgesia (TFA), number of top ups and VAS was recorded at 0.5, 6, 12, 18, 24 h after surgery. Sensory blockade was assessed 30 min after extubation.

Results. Analgesia was significantly prolonged in group mPEC2 [mean(SD)] 313.45(43.05) *vs* 258.87(34.71) min in group PEC1, P<0.001. Total pain experienced over 24 h was significantly less in group mPEC2 [mean(SD)] 9.77(6.93) than in group PEC1 24.19(10.81), P<0.0001. Consequently, top up requirements were significantly reduced in group mPEC2 than in group PEC1 [median(range)] 3(2-4) *vs* 4(3-5) respectively, P<0.001. Lateral pectoral (77.42% and 35.48%) and thoracodorsal nerves (93.55% and 48.39%) had higher incidence of sensory block in group mPEC2 than group PEC1, P<0.001.

Conclusions. mPEC2 provides better postoperative analgesia than PEC1 when catheters are placed under direct vision after MRM.

Clinical trial registration. CTRI/2017/02/007811 (REF/2015/11/010185).

Key words: analgesia; modified radical mastectomy; nerve block; postoperative period; regional anaesthesia; surgery

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Editor's key points

- Regional anaesthesia may have some benefits for managing acute pain after mastectomy.
- It is unclear if different approaches to pectoral nerve block confer any analgesic advantage.
- This study compared the analgesic efficacy of direct catheter placement between different muscle layers.
- The modified PEC2 block provided better analgesia, with local anesthetic spread towards the axilla.

Patients undergoing modified radical mastectomy (MRM) under general anaesthesia consume 6 to 48 mg of morphine,[1 2] putting them at a risk of developing opioid induced side-effects.[3] Pectoral nerve (PEC) blocks have been shown to provide satisfactory analgesia after breast surgery and decrease opioid consumption.[4 5] As the presence of a catheter in and around the surgical site can be a hindrance and undesirable, conventionally PEC blocks are performed preoperatively under ultrasound guidance, as "single-shot injections"[6–8] with no provision to continue PEC block during the postoperative period. Hence different techniques of prolongation of the blocks, such as supplementing PEC block with other blocks[9] have been tried to prolong the duration of PECs block. Placing the catheter under direct vision[10 11] before wound closure will ensure accuracy and provide a route to deliver continuous analgesia in the postoperative period.

Conventionally in PEC1 block, injection is made between pectoralis major and minor muscles, while in PEC2 block in addition to PEC 1 block another injection is made between pectoralis minor and serratus anterior. As the anatomical compartments are breached after surgery, the technique of administering postsurgical PEC2 block without combining it with PEC1 has been termed by the authors as modified PEC2 (mPEC2) block.

It has been demonstrated that PEC2 block provides better quality of analgesia than compared with PEC1 when given preoperatively.[12] However, it remains to be seen whether the disruption of interfascial planes after surgery will alter the spread of the local anaesthetic and efficacy of PEC1 and PEC2 blocks. This study was therefore designed to compare PEC1 and mPEC2 block (local anaesthetic injected between pectoralis minor and serratus anterior) as the modality for postoperative pain relief in patients undergoing modified radical mastectomy. The primary aim of the study was to compare analgesic efficacy of PEC1 and mPEC2 block in terms of time for first rescue analgesic, VAS score and number of top-ups in 24 h. The secondary aims were to map the spread of sensory block and to observe side-effects if any.

Methods

This double blinded, randomized, clinical trial was conducted after obtaining approval from the institutional ethical committee (Reg. No. ECR/62/Inst/WB/2013) dated 26/05/2015, and CTRI registration CTRI/2017/02/007811 [CTRI registration was applied in November 2015 (REF/2015/11/010185); final modifications were submitted in February 2016, CTRI registration number was confirmed on February 8th, 2017]. Sixty-two ASA grade I–II female patients in the age group of 35–65 yr, undergoing unilateral modified radical mastectomy under general anaesthesia, were recruited for the study after obtaining the written informed consent. Patients with history of hypertension, diabetes, known allergy to local anaesthetic, major cardiac disorders, renal dysfunction, pre-existing neurological deficits, and psychiatric illness were excluded in addition to patients who refused to participate in the study (two patients were excluded from initially recruited 64 patients). All patients were kept nil orally overnight and premedicated with oral alprazolam 0.25 mg and ranitidine 150 mg the night before and two h before surgery. During the preoperative visit, patient characteristics data was recorded and visual analog scale (VAS; 0–10, 0=no pain, 10=worst pain) was explained to the patients.

Patients were randomly allocated into two groups (Group PEC1, n=31 and Group mPEC2, n=31) using computer-generated random numbers (Fig. 1). The group allocation numbers were concealed in sealed opaque envelopes that were opened after enrollment of the patients. The catheter was placed between pectoralis major and minor in Group PEC1 and between pectoralis minor and serratus anterior in Group mPEC2 before wound closure under direct vision by the operating surgeon (Fig. 2).

In the operating room, 18-gauge i.v. cannula was cited on the opposite side and baseline ECG, heart rate (HR), non-invasive blood pressure (NIBP), and peripheral oxygen saturation (Sp_{O_2}) were recorded using a multiparameter monitor. General anaesthesia was induced with i.v. fentanyl 1 μg kg^{-1} followed by propofol 1.5–2 mg kg^{-1} i.v. until loss of verbal response. Tracheal intubation was facilitated with atracurium 0.5 mg kg^{-1} and anaesthesia was maintained with isoflurane (minimal alveolar concentration 1–1.3) and 66% nitrous oxide in 33% oxygen through a circle system. Patient's lungs were ventilated with positive pressure ventilation to maintain end-tidal carbon dioxide between 4.0 and 4.5 kPa. ECG, NIBP, Sp_{O_2}, end tidal carbon dioxide and nasopharyngeal temperature were continuously monitored and recorded throughout surgery. All patients received a continuous infusion of ringer lactate solution at the rate of 5–8 ml kg^{-1} h^{-1} during surgery. Fentanyl 25 μg was given i.v. if mean bp or heart rate exceeded 20% of the preoperative value. Any incidence of hypotension (mean arterial pressure<65 mm Hg) was treated with rapid infusion of 200 ml ringer lactate and, if required, injection mephentermine was given in 3 mg i.v. boluses. Bradycardia (HR < 50 beats min^{-1}) was treated with i.v. atropine (0.6 mg). All the patients received ondansetron 0.1 mg kg^{-1} i.v. over 20 min before completion of surgery. At the end of surgery before wound closure, a perforation was made with 18 gauge Tuohy needle (B. Braun, Germany: Perifix® one 401 filter set) just below clavicle and an epidural catheter was passed through it. The surgeon placed the catheter with the tip directed towards axilla, either between pectoralis major and minor muscle (Group PEC1), or between pectoralis minor and serratus anterior (Group mPEC2). Once the skin closure was completed, 30 ml of 0.25% bupivacaine was injected through the catheter under complete aseptic conditions and surgical drains were kept clamped for 15 min before making the injection. Residual neuromuscular block was antagonized with the mixture of neostigmine (2.5 mg) and glycopyrrolate (0.4 mg) i.v. and tracheal extubation was performed when the patient was fully awake.

In the postoperative recovery room pain intensity was measured with VAS score at 0.5 h, six, 12, 18, 24 h postoperatively. At 30 min, postoperatively sensory block was assessed for lateral pectoral, median pectoral, intercostals, thoracodorsal and long thoracic nerves with pin prick method in their area of distribution, barring the area of surgical incision. Time for first analgesic top up (primary outcome measure of the study) was noted when the VAS reached>4 or if the patient demanded analgesia. Each top up comprised of 15 ml of 0.25% bupivacaine and the number of top ups required in 24 h were noted in all patients. If the pain relief was inadequate after a top up dose (VAS score>4), rescue