J Anesth (2011) 25:760–764
DOI 10.1007/s00540-011-1194-4

CLINICAL REPORT

Multilevel nerve stimulator-guided paravertebral block as a sole anesthetic technique for breast cancer surgery in morbidly obese patients

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Received: 5 August 2010 / Accepted: 20 June 2011 / Published online: 12 July 2011

Abstract In this case series, we present the effectiveness of multilevel nerve stimulator-guided paravertebral block (PVB) technique in obese women of body mass index $\geq$30 kg/m^2 undergoing breast cancer surgery with or without axillary dissection. Twenty-six obese women were included in this case series. Block classification, hemodynamics and complication rate, postoperative nausea and vomiting, postoperative analgesic consumption, post-anesthesia care unit (PACU) stay, and hospital stay were recorded. All patients were hemodynamically stable during the operation, and no complications were noted. Patients stayed 69 min on average in the PACU and were discharged within 2 days. Confirmation of the landmark was established from the initial attempt in 61.5%. Surgical PVB was achieved in 76.9% of the patients; the failure rate of the technique was 11.5%. This case series suggested that the multilevel nerve stimulator-guided PVB may be an effective technique for obese patients undergoing breast cancer surgery, although further studies are needed to compare PVB and general anesthesia.

Keywords Paravertebral block · Morbid obesity · Breast cancer surgery

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Introduction

Breast cancer surgery under general anesthesia (GA) for morbidly obese patients has increased risks of complications [1–3]. Paravertebral block (PVB) was introduced as an alternative to GA providing minimal airway intervention, less cardiopulmonary depression, and a decrease in postoperative nausea and vomiting (PONV), pain, analgesic consumption, and hospital stay [4–8]. However, despite the success rate of PVB in the setting of breast surgery, few studies included obese patients with body mass index (BMI) >35 kg/m^2 [9], and others recommended that patients with a BMI >25 kg/m^2 should not be included because of the potential complications in this group [10, 11].

We report our experience in 26 morbidly obese women with BMI $\geq$30 kg/m^2 undergoing breast cancer surgery with or without axillary dissection under multilevel nerve stimulator-guided PVB as the sole anesthetic technique.

The effectiveness of PVB was determined in terms of possible complications and intraoperative hemodynamic stability, as well as patients' and surgeons' satisfaction.

Case series

This case series was approved by the Institutional Review Board. A written informed consent was obtained from all patients. Twenty-six female patients with BMI $\geq$30 kg/m^2 who were scheduled for breast cancer surgery during the period from October 2005 to December 2006 underwent PVB as the sole anesthetic technique. Patients with known allergies for local anesthetics and opioids, anatomical abnormalities in the spine or paravertebral region, and coagulopathies were excluded.

After application of standard anesthesia monitors in the operating room, the patient was placed in the lateral decubitus position with the side to the blockade uppermost, and thoracic PVB was performed. The number of segments for PVB was determined according to the type and nature of the surgical procedure; for simple mastectomy two or three injections were performed, for partial mastectomy four or five injections, and for modified mastectomy five injections [8]. Nineteen patients were not sedated during performing the block, whereas 7 patients were apprehensive and requested light sedation before performing the block; however, they maintained good response to verbal stimuli (1 mg to a maximum dose of 5 mg of midazolam given intravenously). The details of the PVB were described previously [6].

In obese patients, locating the landmark at the T1–T5 level may be difficult. In such cases, we attempt to determine the landmark at a different level (T11–T12) as a guide, and then deduce the landmark at the T1–T5 level by assuming (based on our experience) that the distance between each two consecutive vertebrae is 2–2.5 cm. Hence, after locating the T11–T12 level, we move gradually upward (2–2.5 cm at a time) to the T5 level. The T11–T12 region was selected because it is least likely to be related to any major complications, such as pneumothorax [12].

Once the "most probable" landmark at T4–T5 was identified, a 21-G insulated needle (10- or 15-cm Stimuplex; Braun, Melsungen, Germany)—already attached to a nerve stimulator (initially stimulating current 2.5–5 mA, 1 Hz, 9 V)—was advanced perpendicular to the skin, until a confirmation of dorsal muscle contraction occurred. If no contraction was detected, the needle was manipulated a few millimeters upward or downward. If still no contraction is achieved, then the needle is withdrawn and the landmark is relocated a few millimeters (upward or downward) from the initial position, and detection of the dorsal muscle contraction is repeated. The needle is then advanced until intercostal muscle contraction is confirmed visually, by manual palpation, or by patient confirmation (while the stimulating current is reduced to 0.4–0.6 mA).

Data collected included patient characteristics such as age, weight, height, American Society of Anesthesiologists (ASA) Performance Status (PS) 1–3, type of surgery, intraoperative hemodynamic assessments, intraoperative use of fentanyl, operation duration, post-anesthesia care unit (PACU) stay, PONV, postoperative analgesic consumption during the first 24 h, and hospital stay. Patients and surgeons were also requested to give an assessment of the technique as: unsatisfactory or satisfactory.

Each block performed was classified as surgical, partial block, or failed. A block was defined as "surgical" if the first attempt at placing the block or needle redirection resulted in adequate anesthesia for surgery. Partial block was defined as any need of intraoperative sedation or opioids within the first 30 min in the recovery room. Block failure was defined as the need to repeat the block or the need for GA conversion.

PONV was recorded as definite within the predetermined time intervals, if the patient had experienced nausea and/or vomiting for more than 10 min. A rescue analgesic, meperidine 1 mg/kg (maximum daily dose, 200 mg; Dolosal, Renaydan, France) or an oral combined tablet of dextropropoxyphene 30 mg and paracetamol 400 mg (maximum daily dose, 180 mg; Diantalvic, synovi-Avantys, Lebanon), was administered if the 100-mm linear visual analogue scale (VAS) for pain (0 mm = no pain, 100 mm = worst pain imaginable) was >40 mm.

The characteristics of the 26 patients are presented in Table 1. Twenty-five patients included in our series had successful multilevel nerve stimulator-guided PVB block and maintained intraoperative hemodynamic stability. One uncooperative 59-year-old woman (ASA PS 2 and BMI 35.2 kg/m^2) underwent GA and was not followed up.

This case series showed that 20 patients of 26 (76.9%) completed their surgery under PVB as a sole anesthetic technique with no need for additional sedation (Table 2). A detailed description of the difficulties encountered while performing the PVB is presented in Table 2. Confirmation of the landmark was established from the initial attempt in 61.5% and was relocated (once or twice) in 38.5% of the patients. Confirmation of the dorsal muscle contractions was done by manual palpation in 42.3%. Most intercostal muscle contraction confirmation was done relying on manual palpation (53.8%) while this was ascertained both visually and manually in only 7.7% of the patients. In two cases (under sedation) the procedure failed and was repeated on the next day (without sedation).

The perioperative variables are presented in Table 3. Patients maintained hemodynamic stability during the

Table 1 Patient characteristics

Number of patients	26
Age (years)	54 (39–66)
Weight (kg)	93.0 (73–115)
Height (cm)	161.5 (155–172)
Body mass index (kg/m^2)	
30–35	13 (50.0%)
35–40	8 (30.8%)
>40	5 (19.2%)
American Society of Anesthesiologists (ASA) classification	
ASA 1	5 (19.2%)
ASA 2	12 (46.2%)
ASA 3	9 (34.6%)
Type of surgery	
Simple	4 (15.4%)
Modified radical with axillary desection	11 (42.3%)
Partial	11 (42.3%)

Data are presented as median [min–max] or number (%)

Table 2 Confirmation of landmark and muscle contraction using nerve stimulator-guided paravertebral block (PVB)

	Number (%)
Number of patients	26
Landmark determination	
Confirmed using initial landmark	16 (61.5%)
Changing initial landmark once	8 (30.8%)
Changing initial landmark twice	2 (7.7%)
Confirmation of dorsal muscle contraction	
Visual observation	15 (57.7%)
Manual palpation	11 (42.3%)
Confirmation of intercostal muscle contraction	
Visual observation + manual palpation	2 (7.7%)
Manual palpation	14 (53.8%)
Patient's sensation	10 (38.5%)
Block classification	
Surgical	20 (77.0%)
Partial block	3 (11.5%)
Repeated	1 (3.8%)
Repeated and partial block	1 (3.8%)
Converted to general anesthesia (GA)	1 (3.8%)

Data are presented as number (%)

operation, with no significant difference between pre-incision and post-incision measurements (measured 1 min pre- and 1 min post incision) concerning the heart rate and blood pressure. Four patients (16%) needed fentanyl during the operation (Table 3). On average, the PVB procedure was performed in 12 min. Patients in the PACU were further monitored and stayed on average for 69 min and were discharged within 2 days. Most of the patients (96%) and the surgeons (96%) were satisfied (Table 3).

Table 3 Perioperative patient characteristics

		P value
Number of patients	25*	
Heart rate (beats/min)		
Pre incision	77.8 ± 9.9	
Post incision	76.0 ± 9.5	0.832
Systolic blood pressure		
Pre incision	126.3 (mmHg) ± 10.9	
Post incision	126.5 (mmHg) ± 11.4	0.952
Diastolic blood pressure		
Pre incision	73.3 (mmHg) ± 6.3	
Post incision	69.4 (mmHg) ± 6.5	0.626
Fentanyl during operation (patients)		
150 (μg)	1 (4%)	
250 (μg)	3 (12%)	
PVB procedure duration (min)	12 ± 4	
Operation duration (min)	156.5 ± 15.5	
Recovery room stay (min)	69.3 ± 21.4	
Postoperative nausea and vomiting (PONV)		
6 h post operation	3 (12.0%)	
Analgesics consumption (patients)		
Immediately after the operation	3 (12%)	
At 6 h post operation	9 (36.0%)	
At 12 h post operation	12 (52.0%)	
At 24 h post operation	11 (44.0%)	
Hospital stay		
Same day	–	
1 day	10 (40.0%)	
2 days	15 (60.0%)	
Patients' satisfaction**	24 (96.0%)	
Surgeons' satisfaction**	24 (96.0%)	

Data are presented as mean ± SD or number (%)

* The sum of patients is 25 because 1 case was converted to general anesthesia (GA) and was not followed up

** Patients' and surgeons' satisfaction was assessed after the surgery

Discussion

Our case series in 26 morbidly obese patients with BMI ≥30 kg/m^2 investigated the possibility to perform multi-level nerve stimulator-guided PVB as the sole anesthetic technique for breast cancer surgery with or without axillary dissection. In two of the seven sedated patients, PVB was repeated, and one uncooperative case was converted to GA.

Previous studies showed that PVB in obese patients is associated with more complications and is difficult to perform [6]. One of the reasons that might be behind such a judgment is that in obese patients identifying the appropriate landmarks becomes technically difficult when performing PVB using the classical approach of bone contact [4, 13]. A negative correlation between BMI and the contact with the transverse process (TP) was found; as BMI increases, the percentage of TP contact decreases [4]. In an analysis of 9,038 blocks, the prevalence of block failure rates was 12.7% in patients with BMI $\geq$30 kg/m^2. Acute block complications were encountered in 0.3% of patients and were significantly higher in obese patients [14]. The failure rate was similar to our results (11.5%); however, no complications were noted in our case series.

The use of a nerve stimulator increases the reliability and the accuracy of the PVB technique, resulting in higher success rates and reduced rates of complications [6, 15]. This point was evident because we did not advance the needle unless we had confirmation of the corresponding muscle contractions (visually or by manual palpation, or by patient's sensation), and we never injected the anesthetic solution unless intercostal muscle contraction was achieved (Table 3).

An important factor that may contribute to the success of the block is having a cooperative and unsedated patient while performing the block. In obese patients, the ratio of fat to muscle is high, which may form a barrier influencing the visual and physical detection of response to the intercostal muscle contractions. In two of the seven sedated patients (46- and 56-year-old women, with ASA PS 3, and BMI 38.3 and 40.2 kg/m^2, respectively), the pinprick test revealed incomplete surgical block. The PVB could not be repeated on the same day, because the effect of sedation and the local anesthetic mixture would still be present, and the block was repeated on the next day without sedation. Multilevel injection of PVB has been shown to produce a more reliable sensory block and longitudinal spread than that achieved by injecting the same volume of anesthetic solution in one single site [12].

An important finding to this case series is the success rate, 76.9%. Although we performed the blocks on morbidly obese patients (mean BMI = 36 kg/m^2), another study by Greengrass et al. [16], using a more conventional PVB approach for patients (mean BMI = 25.1 kg/m^2), resulted in a success rate of 80% (20/25). One plausible reason for the partial block observed in three patients was that the surgeon(s) extended the incision during these operations. Ample discussion about surgical incision before the surgery and selecting the proper number of PVBs are important.

We conclude that multilevel nerve stimulator-guided PVB is an effective sole anesthetic technique for morbidly obese patients with BMI $\geq$30 kg/m^2 undergoing breast cancer surgery with or without axillary dissection, with no reported adverse effects or complications. Further studies are needed to compare PVB with GA for obese patients undergoing breast cancer surgery.

Acknowledgments Support was provided from institutional and/or departmental sources.

Conflict of interest These authors reported no conflicts of interest.

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