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Peripheral Nerve Stimulator-Guided Regional Anaesthesia for Modified Radical Mastectomy in High-Risk Patients – A Case Series

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Abstract

Thoracic paravertebral block (TPVB) is an effective and time-tested regional anesthesia (RA) technique of anesthesia/analgesia for breast surgeries. It can be performed by landmark guided, peripheral nerve stimulator (PNS) guided or ultrasound-guided techniques. We used PNS guided TPVB for carcinoma breast surgery in fifteen high-risk patients where general anesthesia was not feasible. All patients had undergone surgeries under standalone RA techniques and without any block-related complications. We describe 15 cases in which PNS guided TPVB and supraclavicular brachial plexus block were performed to conduct modified radical mastectomy under RA and monitored anesthesia care.

Keywords: Paravertebral block, Supraclavicular brachial plexus block, Carcinoma breast, Postoperative analgesia.

Introduction

Thoracic Paravertebral block (TPVB) is a popular and effective regional anesthesia (RA) technique for breast cancer surgeries. It can be performed by Landmark guided, Peripheral nerve stimulator (PNS) guided or ultrasound-guided techniques [1]. Landmark guided TPVB is performed by loss of resistance technique which requires multiple level injections. Various complications like vascular puncture (6.8%), hypotension (4%), epidural or intrathecal spread (1%), pleural puncture (0.8%) and pneumothorax (0.5%) have been reported [2]. TPVB under ultrasound guidance allows real-time visualization of pleura, lung tissue, and advancement of the needle or a perineural catheter during the performance. Anaesthesiologists without access to an ultrasound machine or training in ultrasound-guided RA can also perform this block with PNS guided technique. Bonica et al. first suggested the use of PNS to perform TPVB, which was later modified by Wheeler et al. [3, 4]. The stimulation of ventral rami with PNS, yields the end motor response of intercostal muscle contraction which helps to identify the correct space for local anesthetic (LA) deposition. A motor response at a current of 0.2–2.0 mA. is desirable and it causes a simultaneous electrically induced paraesthesia in approximately 30–40% of the patients [4]. Lang et al. also described a similar technique in 2002 [5].

TPVB does not block the medial and lateral pectoral nerves which can be blocked by pectoral interfacial plane blocks. If it is not feasible, a supraclavicular brachial plexus block (SCBPB) may be used to block the medial and lateral pectoral nerves (MPN, LPN) [6].

To our knowledge, the combination of PNS guided TPVB and SCBPB for breast surgeries in high-risk patients has not been described in the literature. We describe the use of PNS guided TPVB and SCBPB to facilitate modified radical mastectomy(MRM) under RA and monitored anesthesia care (MAC) in terms of optimal perioperative analgesia and intraoperative hemodynamic stability in fifteen high-risk patients.

Case Reports

The anesthesia plan was discussed with the patient and relatives and written informed consent was taken from each patient during pre-anesthetic check-up (PAC). Consent for perioperative collection of data and possible publication was also taken. All details were recorded in a mobile app Regional Anesthesia Database (RAD v1.4.1.24, Medusys). The collected data includes age, gender, American Society of Anaesthesiologists physical status (ASA) of the patient, Comorbid conditions, weight, height, diagnosis, the surgical procedure being performed, duration of surgery, medications used for sedation, current (mA) used for nerve stimulation, duration of analgesia, the total dose of rescue analgesic needed in first 24 hours, any complications, days spent in high dependency unit /intensive care unit (HDU/ICU) and the total duration of hospital stay following surgery (Table 1, 2).

All patients were admitted overnight and underwent preoperative assessment and counseling. Patients were duly explained about the procedure and the necessity for this type of anesthesia, especially because it involved three needle pricks. All 15 cases were done under PNS guided TPVB and SCBPB in ASA grade II/III patients with multiple comorbidities. On the day of surgery, an intravenous line was secured and ASA standard monitors were attached. PNS guided TPVB was performed in the sitting position.

The superior aspects of the spinous processes of C7-T6 were marked. The TPVB was performed at two levels: at T1 and T5. A point was marked 2.5-3.0 cm lateral to the spinous process. A 22 G 100 mm Stimuplex® needle was inserted perpendicular to all planes with the initial current at 1.0 mA. The needle was advanced slowly until the

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Table 1: Summary Demographic profile

Case	Age & Sex	ASA PS	Co-morbid conditions	Weight (kg)	Height (ft)	Diagnosis	Surgery	Duration of surgery (min)
1	88/F	III	CABG, COPD, DM, HT	75	5'3"	Left Ca Breast	Left MRM	120
2	77/F	III	DM, IHD, LVEF-35%	98	5'2"	Left Ca Breast	Left MRM	90
3	68/F	II	Post covid-19 positive COPD	82	5'5"	Right Ca Breast	Right MRM	115
4	82/F	III	LVEF-30%, IHD, DM	68	5'3"	Right Ca Breast	Right MRM	90
5	57/F	III	LVEF-40%, Bronchiectasis	80	5'2'	Left Ca Breast	Left MRM	120
6	66/F	III	LVEF-40%, HT	90	5'1"	Left Ca Breast	Left MRM	90
7	58/F	II	COPD	95	5'3"	Right Ca Breast	Right MRM	75
8	69/F	III	DM, HT, Obesity	110	5'4"	Right Ca Breast	Right MRM	30
9	78/F	III	LVEF-25%, COPD	58	5'0"	Right Ca Breast	Right MRM	40
10	82/F	III	LVEF-20%, DM, IHD	60	5'2"	Right Ca Breast	Right MRM	120
11	50/F	III	Obesity, LVEF-40%, HT	98	5'1"	Left Ca Breast	Left MRM	90
12	66/F	III	COPD, BA, Parkinsonism	78	5'7"	Right Ca Breast	Right MRM	60
13	87/F	III	BA, DM, Epilepsy	50	5'2"	Right Ca Breast	Right MRM	45
14	78/F	II	DM, IHD, HT, LVEF-40%	68	5'4"	Left Ca Breast	Left MRM	120
15	85/F	III	COPD, B/L Lung infiltrates, Kyphoscoliosis	45	5'2"	Right Ca Breast	Right MRM	110

ASA PS = American Society of Anesthesiologist Physical Status; M = Male, F = Female; MRM= modified radical mastectomy, BA = bronchial asthma, COPD = chronic obstructive pulmonary diseases, IHD = ischaemic heart disease, HT=hypertension, DM= Diabetes Mellitus, LVEF= left ventricular ejection fraction, CABG= Coronary artery bypass grafting

Table 2: Intraoperative and Postoperative parameters

Case	i.v. sedation	Current on PNS	Duration of analgesia (min)	Total requirement of rescue analgesic in first 24 hours	Complications	Need for ICU/HDU stay	Total duration of hospital stays following surgery
1	Mz – 1mg, F – 50 mcg	0.8, 0.65, 0.42	36hrs	-	Nil	1day	2days
2	Mz – 2 mg, Ket -20mg, Dext – 30mcg	1.1, 1.0, 0.62	48hrs	-	Nil	1day	3 days
3	Mz – 2 mg, Fn - 30 mg	0,76, 0.8, 0.5	48hrs	-	Nil	Nil	1days
4	Mz – 2 mg, F– 50 mcg	0.58 0.8, 0.48	48hrs	-	Nil	Nil	2days
5	Mz– 1 mg, Fn– 15 mg	0.63, 0.8 0.4	48 hrs	-	Nil	Nil	3days
6	Mz – 2 mg, Fn- 30 mg	0.7, 0.62, 0.38	48 hrs	-	Nil	Nil	2 days
7	Mz – 2 mg, Fn – 30 mg, Dext – 20 mcg	0.82, 0.1, 0.6	36 hrs	-	Nil	Nil	2days
8	Mz – 1 mg Dext - 30 mcg	0.8, 1.0, 0.62	48 hrs	-	Nil	Nil	3 days
9	Mz – 2 mg, Fn - 15 mg	0.68, 0.8, 0.4	48hrs	-	Nil	Nil	4 day
10	Mz – 1 mg, Fn - 15mg	0.8, 1.1, 0.68	36 hrs	-	Nil	Nil	3 days
11	Mz – 2 mg, F – 50 mcg	1, 0.9, 0.58	48 hrs	-	Nil	Nil	2days
12	Mz – 2 mg, F – 50 mcg, Dext-50 mcg	0.72, 0.6, 0.5	48 hrs	Iv Tramaadol-50mg	Nil	Nil	2 days
13	Mz 1 mg, F 50 mcg	0.68, 0.8, 0.48	48 hrs	-	Nil	Nil	2 days
14	Mz 2 mg, F-50mcg	0.62, 0.9, 0.6	48 hrs	-	Nil	Nil	2 days
15	Nil	0.8, 0.72, 0.5	48 hrs	-	Nil	2 days	2 days

ASA PS = American Society of Anesthesiologist Physical Status; M = Male, F = Female; ST= Subtotal thyroidectomy; i.v. = intravenous, Mz = midazolam, Ket= ketamine, Dext = dexmedetomidine, F= fentanyl, Fn= Fortwin, current on PNS = at T1, at T5 and for supraclavicular block respectively

transverse process of the lower vertebra was contacted. The needle was then withdrawn, walked off the transverse process caudally, and advanced further to look for end motor response i.e. intercostal muscle twitch. In the axilla (T1 and T2 levels) the twitches are better felt than seen. Whereas the contractions are better seen at the T5 level. The current was then gradually reduced to 0.5 mA before injection. The current can stimulate the sympathetic chain. Hence vigilant monitoring is required at this point. After negative aspiration for blood and air, 10 ml of LA was injected at each level (10 ml 2% lignocaine-adrenaline and 10 ml 0.75% ropivacaine).

PNS guided SCBPB was also performed in each patient to block the MPN and LPN. 10 cc of LA solution (5 ml 2% lignocaine-adrenaline and 5 ml 0.75% ropivacaine) was injected after negative aspiration for blood and air.

The block was assessed by spirit-soaked cotton and blunt tip needle in the desired dermatomes. Intravenous midazolam, ketamine, fentanyl, pentazocine, or dexmedetomidine were used for anxiolysis and sedation depending on the associated comorbidities (Table 1, 2). All patients received 1 gm of paracetamol intraoperatively. Patients' heart rate, 3-lead ECG, CO_2, and SpO_2 were monitored continuously. All patients received O_2 inhalation by nasal prong at a rate of 2-3 lit/min. Postoperatively, all patients received 1 gm paracetamol 6th hourly (Table 1). None of the patients required rescue analgesia in the first 24 hours except one patient (Case No.12) who required 50 mg Tramadol intravenously. Duration of surgery was recorded.

One of our patients (case 3) was recovered from novel corona virus infection. She was posted for right MRM after one month.

All patients successfully underwent MRM under stand-alone RA and MAC. None of the patients had any intraoperative complications. Following surgery, high-risk patients were kept in ICU/HDU for observation and were discharged within 3-4 days.

Discussion

TPVB provides effective anesthesia and/or analgesia for breast surgeries. It also effectively reduces the incidence of persistent postoperative pain or chronic pain [7]. TPVB in breast surgery imparts better control of pain, reduces postoperative opioid consumption, decreases postoperative nausea, vomiting, and length of hospital stay [8].

Naja et al. studied the effectiveness of multilevel PNS guided TPVB technique in obese women (body mass index ≥30 kg/m^2) undergoing breast cancer surgery with or without axillary dissection. Out of 26 patients, surgical anesthesia was achieved in 76.9% and the failure rate was 11.5%. All of our patients had multiple comorbid conditions. Out of 15 patients, 12 were of ASA III and rest were of ASA II category. Hence, general anesthesia (GA) was not feasible for them.

Patnaik et al. compared the landmark technique with ultrasound-guided TPVB for providing surgical anesthesia in breast surgeries. Although, they observed that USG guided TPVB was better than the landmark technique but there were no differences in complications [9]. Interscalene brachial plexus block (ISB) and superficial cervical plexus block along with TPVB was used for MRM in a patient with ischemic heart disease [10]. ISB helped to block MPN and LPN which is not blocked by TPVB. We performed PNS guide SCBPB with a low volume of LA which helped in blocking MPN, LPN, and the first thoracic spinal nerve(T1) which helped for axillary clearance of node.

PNS helps in more precise localization of paravertebral space and safe performance of the block as compared to landmark guided loss of resistance technique. PNS guided TPVB has been used for excision biopsy in female and gynecomastia surgery in male patients with adequate intra-operative anesthesia and postoperative analgesia for more than twelve hours without any complications [5, 11]. We used PNS guided TPVB as a stand-alone anesthesia technique in high-risk patients without any major complications.

Recently Coronavirus disease 2019 (COVID-19) has had a significant impact on perioperative management. Various societies have recommended the use of RA techniques whenever possible in suspected or confirmed cases of novel corona virus disease [12]. The use of RA may reduce the need for GA and the associated risk from aerosol-generating procedures. PNS guide TPVB and SCBPB may be safely used by experienced anaesthesiologists as stand-alone RA technique during this pandemic to avoid GA.

Conclusion

Modified radical mastectomy under PNS guided RA (PVB and SCBPB) with MAC can be performed safely in high-risk cases with favorable outcomes and without any serious complications.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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