Analgesia in Patients with or without Single-shot Lamina Thoracic Paravertebral Block Following Breast Cancer Surgery in a Nigerian Hospital

A Rukewe[1], A F Ademola[2],   A A Fatiregun[3], A Ugheoke[1]
[1]Department of Anaesthesia, University College Hospital, Ibadan, Nigeria.
[2]Department of Surgery, Division of Oncology, College of Medicine, University College Hospital, Ibadan, Nigeria.
[3]World Health Organization, Akure Office, Ondo State, Nigeria.
Correspondence to: Dr. Ambrose Rukewe, Email: ambyrukewe@gmail.com.

Background: **In this pilot study, we evaluated the postoperative analgesic effect of the new lamina thoracic paravertebral block using a single-shot technique for major breast cancer surgery.**
Methods: **A retrospective observational design was used to compare data involving 16 consecutive ASA 1 and 2 female patients who had unilateral modified radical mastectomy with axillary clearance under general anaesthesia with paravertebral block and 15 others without block between 13/03/2014 to 12/05/2015. We compared the time to the first request for analgesic, total analgesic (opioid and non-opioid) consumption (in mg) and postoperative pain scores over 72 h between the two groups.**
Results: **One patient was excluded from the cohort due to block failure. The median time to first request for analgesic was 43 h (25.2-73.0 h) in the block group versus 2 h (1.0-2.5 h), p=0001. The pain scores was significantly lower at all measurement points among the block patients compared with the no-block group until 24 h postoperatively. No patient in the block group required analgesic within 24 h after surgery. The total consumption of pentazocine was nil (block group) vs. 154.0±74.2 (range 90-300) mg, p=0.0000001.**
Conclusions: **Single-shot lamina paravertebral block provided prolonged postoperative analgesia and reduced opioid and non-opioid consumption**.

Introduction

Modified radical mastectomy with axillary clearance is the preferred surgical treatment of breast cancer in many parts of the world.[1] However, effective postoperative pain management remains a challenge in low-resource centres partly due to the failure of functional narcotic supply systems.[2,3] In our centre, problems with supply often restrict us to the use of tramadol or pentazocine for severe postoperative pain that usually follows mastectomy. Thoracic paravertebral block (TPVB) has been shown to provide prolonged postoperative pain relief for unilateral breast operations. [4,5] Consequently, our team began performing single-shot TPVB using the new lamina approach as an adjunct to general anaesthesia (GA) for major breast surgery.[6] To the best of our knowledge, no study has investigated the effectiveness of single-shot lamina TPVB. In this pilot study, we investigated the postoperative analgesic effect of single-shot TPVB following modified radical mastectomy with axillary clearance by assessing the time to the first request for analgesic, quantified the total analgesic (opioid and non-opioid) consumption (in mg), and assessed postoperative pain scores over 72 h in patients with or without TPVB.

Patients and Methods

Approval for the study was obtained from Oyo State Ethical Review Committee. We reviewed data (anaesthetic charts, recovery room and ward records) collected during routine clinical management of 31 consecutive ASA physical status 1 and 2 female patients who had unilateral modified radical mastectomy with axillary dissection under GA with or without TPVB. Although the study period was 13/03/2014 to 12/05/2015, clinical work was disrupted over 7 months owing to industrial action by health workers which affected the number of patients operable. Each patient was instructed in the verbal rating scale (VRS) in vernacular validated by Soyannwo et al, as the pain assessment tool before the procedure; 0 = no pain (kosiirora), 1 = mild pain (irora die), 2 = discomforting pain (irora ti o ninilara), 3 = distressing pain (irora ti o banilokan je), 4 = horrible pain (irora ti o ga), 5 = excruciating pain (irora ti o kojaifarada).[7]

Exposures to TPVB were based on the availability of equipment and the anaesthetist to perform the procedure (all the TPVB were performed by the leading investigator). Each patient gave written, informed consent for the anaesthetic technique employed. We compared the time to first request for pain relief between both groups (timed from the completion of surgery), pain scores and total analgesic (opioid and non-opioid) consumption (in mg) for the first 72 h. The VRS charts were kept in the recovery room and ward at 2 h, 4 h, 6 h, 8 h, 12 h, 24 h, 36 h, 48 h, 60 h and 72 h. Every patient received IV injection of pentazocine 30 mg at induction of GA. Postoperatively, patients rated their pain using the VRS scale, if 1 or 2 received paracetamol and if analgesia was inadequate, diclofenac was added; if VRS score ≥ 3/5 pentazocine or tramadol and paracetamol were administered and if analgesia was inadequate, diclofenac was added. There was no premedication given to the patients. The preoperative fasting guideline observed was solid food 6 h and clear fluids 2 h before surgery. In the operating room, intravenous (IV) access was established with an 18G cannula on the non-dominant arm and 500 mL of normal saline solution setup. Monitoring consisted of noninvasive blood pressure, electrocardiography, pulse oximetry and the heart rate using the Classic-120 Multiparameter® monitor (Health-Care Equipment and Supplies Co. Ltd, Egham, Surrey, UK). Each patient's baseline vital signs comprising heart rate, blood pressure and arterial oxygen saturation (SaO_2) while breathing room air was measured and recorded.

The lamina approach used in this study was Juttner et al's modification of Pfeiffer et al's technique.[8,9] Each TPVB patient was placed in the sitting position on the operating table and C7-T6 vertebral spinous processes were palpated and marked. The scapular spine was palpated and identified as a landmark for T3 vertebral spinous process. Thereafter 1.5 cm from the midline on the side to be blocked was marked as the needle entry point. Skin preparation was done with 10% povidone iodine solution and draped. This injection site was infiltrated with 2-3 mL 2% lidocaine with 1:200,000 epinephrine and a 16G Tuohy needle (Perifix, B. Braun, Melsungen, Germany) was inserted and advanced in a paramedian sagittal plane at 45° to the skin in the cranial direction using loss of resistance to air technique with a 20 mL syringe until contact was made with the vertebral lamina usually at a depth of 4-6 cm. After negative aspiration of air,

cerebrospinal fluid or blood, 6 mL 2% lidocaine with 1:200,000 epinephrine was injected, followed by the insertion of 18G catheter (Perifix, B. Braun, Melsungen, Germany) 3.0 cm beyond the needle tip. This step (epidural catheter insertion) was necessary to enter the paravertebral space after making contact with the vertebral lamina even in single-shot technique. After securing the catheter, 5 mL 2% lidocaine with 1:200,000 epinephrine was administered as a test dose while monitoring the patient's pulse rate, blood pressure and consciousness to exclude epidural or subarachnoid injection or pneumothorax. Thereafter, 20 mL 0.5% isobaric bupivacaine with 1:200,000 epinephrine was injected over 5 min. We did not wait to test the block but placed the patient supine on the operating table for the induction of GA. Each catheter was removed after surgery in the recovery room.

Every patient received IV pentazocine 30 mg before induction with propofol 1.5-2.0 mg/kg IV and pancuronium 0.1 mg/kg IV was administered to facilitate tracheal intubation. Anaesthesia was maintained with isoflurane in oxygen and incremental doses of pancuronium 0.01 mg/kg. At the completion of surgery, neostigmine 2.5 mg and atropine 1.2 mg was administered IV to reverse the residual neuromuscular block followed by extubation when the criteria indicating full recovery from anaesthesia were met, such as, SaO_2 above 95%, regular breathing, full wakefulness and obeying commands. Next, the patient was transferred to the postanaesthesia care unit (PACU) for observation for 1 hour. The data was analysed using the statistical package for the social sciences (SPSS for windows 17.0, SPSS Inc., Chicago, IL, USA). The analysis included descriptive statistics such as frequencies, percentages, and inferential statistics such as student t-, Mann-Whitney U and Fisher's exact tests. A P-value of <0.05 was considered statistically significant.

Results

Sixteen patients had TPVB but in one of them, epidural catheter (20G) insertion failed and there was request for rescue analgesic 40 min postoperatively (VRS 4/5). The block was judged to have failed and she was excluded from the TPVB cohort.

Table 1: Demographic profile of patients

Variables	TPVB Group (n=15)	No-block Group (n=15)	P value
Age (year)	51.6 ± 10.4	51.1 ± 12.7	0.91
Weight (kg)	66.5 ± 10.5	75.1 ± 8.7	0.02
Height (cm)	160.6 ± 4.3	164.1 ± 3.7	0.02
BMI (kg/m^2)	25.9 ± 4.7	27.9 ± 2.9	0.19
ASA I/II (n)	7/8	5/10	
Duration of surgery (min)	141.2 ± 33.4	129.5 ± 27.7	
Hospitalisation period (days)	10.9 ± 3.0	11.6 ± 3.0	0.51

Data are numbers and mean values (standard deviation).
The two groups were similar in age, BMI, duration of surgery and hospitalisation (Table 1) excepting the fact that TPVB patients weighed less and were shorter (p=0.02).

The pain scores (VRS) in the recovery room was significantly lower in the TPVB group at all measurement points as shown in Table 2.

Table 2: Recovery room postoperative pain (VRS) scores for the two groups

Time (min)	TPVB Group (n=15)	No-block Group (n=15)	P value
10	0.00 (0.00-0.38)	3.00 (2.00-3.25)	0.0001
20	0.00 (0.00-0.40)	3.00 (2.00-3.00)	0.0001
30	0.00 (0.00-0.00)	3.00 (1.00-3.00)	0.0001
40	0.00 (0.00-0.00)	3.00 (2.00-3.00)	0.0001
50	0.00 (0.00-0.00)	3.00 (2.00-3.00)	0.0001
60	0.00 (0.00-0.00)	3.00 (2.00-3.25)	0.0001

Data are median values (interquartile range)

The VRS pattern continued in the ward until the 24 h mark when there was no significant difference (Table 3).
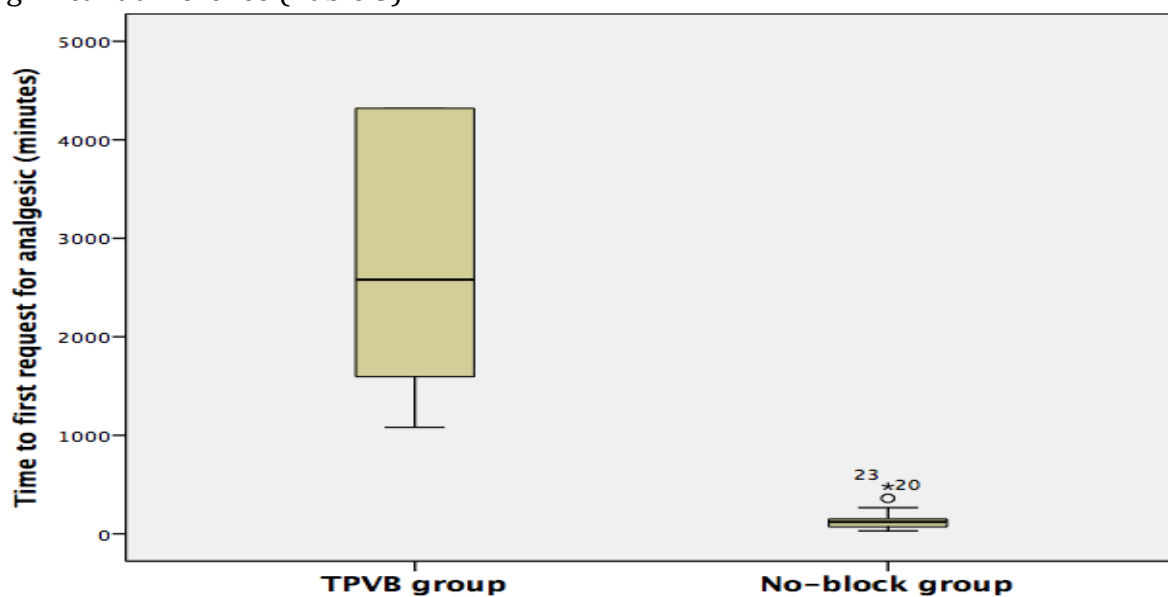

Figure 1: Boxplot for time to first analgesic request after surgery in minutes by group

Table 3: Postoperative pain (VRS) score on the ward for the two groups

Time (h)	TPVB Group (n=15)	No-block Group (n=15)	P value
2	0.00 (0.00-0.00)	2.00 (2.00-3.00)	0.0001
4	0.00 (0.00-0.25)	2.00 (2.00-3.00)	0.017
6	0.00 (0.00-1.00)	2.00 (2.00-3.00)	0.0001
8	0.00 (0.00-1.00)	2.00 (2.00-3.00)	0.001
12	0.00 (0.00-1.00)	2.00 (2.00-3.00)	0.044
24	0.50 (0.00-2.00)	2.00 (2.00-3.00)	0.100
36	1.00 (0.25-1.75)	2.00 (2.00-3.00)	0.047
48	1.00 (1.00-1.75)	2.00 (2.00-2.00)	1.000
60	1.00 (1.00-2.00)	2.00 (2.00-2.00)	1.000
72	1.50 (1.00-2.00)	2.00 (1.00-2.00)	1.000

Data are median values (interquartile range)

No patient in the TPVB group required rescue analgesic during the 1 h recovery room stay compared with 5 (33.3%) patients in the no-block group, p=0.04. The median time to first request for analgesic was 43 h (25.2-73.0 h) in the block group versus 2 h (1.0-2.5 h) in the no-block group, p=0001. This difference is shown in Fig 1.

Discussion

Postoperative pain of moderate-to-severe intensity after major breast surgery for cancer remains a clinical problem in resource-poor settings with under-treatments associated with increased morbidity.[10] Our results indicated that single-shot TPVB using 0.5% bupivacaine with 1:200,000 epinephrine provided prolonged postoperative analgesia, less need for opioid and non-opioid analgesics in patients treated with modified radical mastectomy and axillary clearance for breast cancer compared with patients who had no block. The high success rate (94%) in our small cohort is congruous with the Düsseldorf study (98%) indicating that the lamina technique might produce less failed blocks compared to the classical approach where about 13-27.3% failure rate has been reported.[11-13] The failure we recorded due to the difficulty with 20G catheter insertion was not unexpected, it is easier to tunnel larger-caliber catheters through the superior costotransverse ligament into the thoracic paravertebral space.[8]

Our results of optimal pain control with TPVB are in agreement with the findings of previous studies which showed that TPVB was an effective option for postoperative analgesia and its use obviated the need for epidural block as well as systemic opioids thereby avoiding side effects associated with these therapeutic modalities.[5,8,14,15] TPVB patients reported less pain than their no-block counterparts; there was significant difference in the VRS until 24 h postoperatively. The pain relief was so profound that no patient in the TPVB group required opioid and non-opioid analgesic within 24 h. This observation differs from results of single-shot multi-level TPVBs in which significant differences in pain scores, opioid analgesic consumption lasted 6-8 h.[16,17]Our explanation for this difference is that in the lamina TPVB technique, the catheter that is tunneled into the TPVS allows the injection of a higher LA volume which engenders a better cranio-caudal spread than the multi-level classical approach. The opioid-sparing effect of TPVB is desirable in cancer for perioperative anaesthesia/ analgesia because opioids promote angiogenesis, tumor cell proliferation and metastasis. Regional anaesthesia attenuates cell-mediated immunosuppression and local anaesthetic agents block voltage-gated sodium channels that malignant cells require for growth and spread.[18-20]

We believe that our results are important in our low-resource setting because they show that single-shot lamina TPVB provided optimal pain relief. We acknowledge that the small cohort of patients studied and the lack of randomization with selection bias may be limitations, so we are cautious in the interpretation of our results which suggest that the lamina TPVB is effective and probably easier to perform than the classical TPVB. Our failure to take into account the different stages of the resected breast carcinomas as well as co-existing medical conditions meant that obvious confounding variables were not excluded. In view of the small number of study patients, the power calculation to detect difference in the tramadol consumption was 95%. Prospective

randomised studies with large patient population are required to confirm if lamina TPVB have high success rate and effectiveness as these early results suggest.

Conclusion

Single-shot lamina TPVB technique provided prolonged postoperative analgesia, and reduced opioid and non-opioid consumption.

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