ISSN: 2476-8642 (Print)
ISSN: 2536-6149 (Online)
www.annalsofhealthresearch.com
African Index Medicus, Crossref, African Journals Online, Scopus, C.O.P.E & Directory of Open Access Journals

Annals of Health Research

(The Journal of the Medical and Dental Consultants' Association of Nigeria, OOUTH, Sagamu, Nigeria)

VOLUME 9
NO. 4
OCT. - DEC., 2023

IN THIS ISSUE

PUBLISHED BY THE MEDICAL AND DENTAL CONSULTANTS ASSOCIATION OF NIGERIA, OOUTH, SAGAMU, NIGERIA.
www.mdcan.oouth.org.ng

Annals of Health Research
(The Journal of the Medical and Dental Consultants' Association of Nigeria, OOUTH, Sagamu, Nigeria)

Volume 9, Issue 4: 343-351
December 2023
doi:10.30442/ahr.0904-07-219

ORIGINAL RESEARCH

Comparison of Serratus Anterior Plane Block by Anatomical Landmark-Guided Technique Versus Ultrasound-guided Technique for Gynaecomastia Surgery: A Randomized Controlled Trial

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Abstract

Background: Breast surgeries are common surgical procedures and postoperative pain after mastectomy is a major concern as inadequate pain relief can result in chronic pain and reduced quality of life. Serratus anterior plane (SAP) block is suitable for perioperative analgesia for gynaecomastia correction surgery.
Objectives: To compare postoperative pain relief using the VAS and D-VAS scores between anatomical landmark-guided SAP block and ultrasound-guided SAP block in patients undergoing surgery for gynecomastia correction.
Methods: Patients aged 16-40 years, belonging to American Society of Anaesthesiologists (ASA) physical status I or II who were scheduled for gynaecomastia correction surgery were randomized and allocated into two groups. Group I (n = 15) patients received 20 ml of 0.25 % bupivacaine solution with 20 µg of Fentanyl by anatomical landmark-guided SAP technique while Group II (n = 15) patients in the control group received same drug using ultrasound-guidance technique. VAS and D-VAS from arrival to post anaesthesia care unit (PACU), then after 30 minutes, and at 1 hour, 2 hours, 6 hours, 12 hours, 18 hours, and 24 hours.
Results: Both groups had comparable results in terms of pain scores at different time intervals, duration of analgesia (615 mins vs 706 mins) and need for rescue analgesics.
Conclusion: Anatomical landmark-based SAP block technique is comparable to the ultrasound-guided SAP block technique in terms of efficacy and duration of analgesia with lesser complications. The former can serve as an alternative to the latter technique in resource-limited countries.

Keywords: Bupivacaine, Gynaecomastia, Postoperative analgesia, Regional anaesthesia, Serratus anterior plane block, Ultrasound.

Introduction

Persistent pain is a postoperative complication estimated to affect between 20% and 50% of post-mastectomy patients with substantial negative impact on quality of life. [1] An effective postoperative pain management is necessary as inadequate pain control can further lead to negative clinical outcomes and poor quality of life. Systemic analgesics like acetaminophen, NSAIDS and opioids are mostly used for acute postoperative pain management, however, they have risks of systemic side effects. Therefore, regional anaesthesia techniques are better alternatives. Regional anaesthetic techniques such as neuraxial block, paravertebral block (PVB), intercostal nerve block (ICNB), pectoral nerve blocks and serratus anterior plane (SAP) block are some of the popular methods.[2] In SAP block, a local anaesthetic drug is deposited deep into the serratus anterior muscle in deep interfacial plane and it provides adequate postoperative analgesia for breast and thoracic surgeries by blocking intercostal nerves, long thoracic nerve and the dorsal thoracic nerve. [3 - 5]

Although the ultrasound-guided SAP block described by Blanco *et al.*, [6] holds promising results, but the landmark-guided SAP technique described by Vadera HK *et al.*, [7] has not been studied extensively. The Visual Analogue Score (VAS) and Dynamic-Visual Analogue Score (D-VAS) pain assessment tools are well validated and widely accepted. [8] The ultrasound-guided nerve block techniques use real time imaging and are widely accepted due to their precision and success with lesser complications. However, it requires special training and expertise. In resource-limited developing countries like India, there is a scarcity of both ultrasound facility and experienced personnel. Therefore, the anatomical landmark-guided regional anaesthetic techniques are still practiced extensively. The present study was aimed at comparing pain relief in the anatomical landmark-guided SAP block and the ultrasound-guided SAP block in patients undergoing corrective surgery for gynecomastia using the VAS and D-VAS scores.

Methods

This prospective, randomized, single-blinded, comparative study was carried out at the Department of Anaesthesiology and Critical Care, Pandit Bhagwat Dayal Sharma Postgraduate Institute of Medical Sciences, Rohtak, India. The study conformed with the ethical standards of the institute's Biomedical Research Ethics Committee with formal approval (IEC/Th/19/Anst31) dated 30 December 2019. Informed written consent was obtained from the recruited patients.

A sample size of 30 was calculated based on the study of Semyonov *et al.* [9] using a power of 80%, a significance level of 0.05 and a Standard deviation of 3. Thirty male patients aged 16-40 years, belonging to American Society of Anaesthesiologists (ASA) physical status I or II scheduled for elective surgery for gynecomastia correction were included in this study. Patients with the history of allergic reaction to any local anaesthetic agent, bleeding diathesis, infection at the puncture site, analgesia use, Body Mass Index (BMI) >30 kg/m^2, difficulties in understanding the VAS/D-VAS pain assessment tools and those who were not willing to participate were excluded from the study.

The recruited patients were randomly allocated to one of two groups by computer-generated random numbers. Group I (n = 15) received 20 ml of 0.25 % bupivacaine solution with 20 µg of fentanyl administered by anatomical landmark-based technique (study group) and Group II (n = 15) received 20 ml of 0.25 % bupivacaine solution with 20 µg of fentanyl administered using the ultrasound-guided technique (control group). All the patients were examined during pre-operative

visit, a day prior to surgery. Body weight in kilogram and height in meter were measured and BMI was calculated by the formula: weight (kg)/height (meter ^{2}). The patients were categorized into underweight (BMI<18.5 kg/m^2), healthy (BMI = 18.5 to 24.9 kg/m^2) and overweight (25 to 29.9 kg/m^2). [10] The patients were fasted for six hours for solids and two hours for liquids prior to surgery. They were pre-medicated with oral alprazolam 0.25 mg a night before surgery.

On arrival at the operating room, monitoring lines were established and baseline parameters were recorded. Intravenous assess was secured and the patient was premedicated with intravenous glycopyrrolate 0.2 mg, intravenous fentanyl l 2 µg/kg and induced with intravenous propofol 2.5 mg/kg. Maintenance was achieved with intravenous vecuronium 0.1 mg/kg. Intravenous fentanyl 0.5 µg/kg and intravenous vecuronium 0.01mg/kg were repeated as required. The SAP block was performed postoperatively while the patient was still under the effect of general anaesthesia.

Procedures

In Group I, the patients were kept in the supine position and the ipsilateral upper limb abducted to 90 degrees. The skin of the chest wall was disinfected with 5% povidone-iodine solution. The fifth rib was identified in the mid-axillary line and a 22G needle (1.5 inches short bevelled needle) was inserted and advanced perpendicular to skin to contact the rib surface. Once the needle hits the rib, then the needle was withdrawn by 1-2 mm. At this point, the needle tip lied between serratus anterior muscle and the rib in deep facial plane. After negative aspiration, 20 ml of the anaesthetic agent as described above was injected. [70] Anatomical landmark-guided SAP block was performed by a consultant anaesthesiologist.

In Group II, the SAP block was performed at the level of the fifth rib, using a high frequency linear transducer ultrasound system (Sonosite M-turbo®). First, the subcutaneous tissues were identified. At the intermediate level, the serratus anterior muscles, ribs, latissimus dorsi muscle and pleura at deep level were also identified. The ultrasound probe was oriented in a cranio-caudal direction and a 23 G spinal needle was introduced under continuous ultrasound guidance with the tip deep to the serratus anterior muscle. Once tip of the needle was confirmed in the deep facial plane by hydro-dissection, 20 ml of 0.25 % bupivacaine solution with 20 µg of fentanyl was administered (Figure 1). Ultrasound-guided SAP block was performed by a consultant anaesthesiologist who had undergone Basic Level 1 Provider (BL1 P) training in ultrasonography with at least five years of experience in point-of-care ultrasonography.

SAP blocks were performed bilaterally when bilateral gynaecomastia correction was planned. The duration of block performance was noted and considered as time from the identification of the fifth rib in the mid-axillary line to the injection of drug solution in Group I while in Group II, it was the time taken from placement of transducer to injection of the drug solution. The ease of placement of needle was determined by the person giving the block on a two-point scale of easy or difficult.

Following the completion of the block procedure, the patient was reversed and extubated. Immediately after emergence from anaesthesia, the patients were transferred to the post-anaesthesia care unit (PACU). On arrival at the PACU, pain was assessed by an anaesthesiology resident who was not aware of the study group using the following timings: on arrival, 30 minutes, 1 hour, 2 hours, 6 hours, 12 hours and 24 hours. The pain was assessed using the Visual Analogue Scale (VAS) and Dynamic Visual

Analogue Scale (D-VAS). The scale contains a 10 cm line where 0 cm denotes no pain while 10 cm denotes the worst pain imaginable. [8] The first rescue analgesic (intravenous paracetamol 1 gm) was administered if VAS was ≥4 with minimal interval of at least four hours between the doses. If the patient complained of pain in between the doses of paracetamol, intravenous tramadol 1 mg/kg with a lock out period of 10 minutes was administered over a period of two minutes as a second rescue analgesic. The cut-off value of VAS ≥4 for the administration of rescue analgesic was chosen as this practice is widely accepted. [11 - 13] The side effects, such as postoperative nausea and vomiting (PONV), were assessed on a three-point scale where: 0 = no nausea, no vomiting; 1 = nausea present, no vomiting; 2 = vomiting present, with or without nausea.

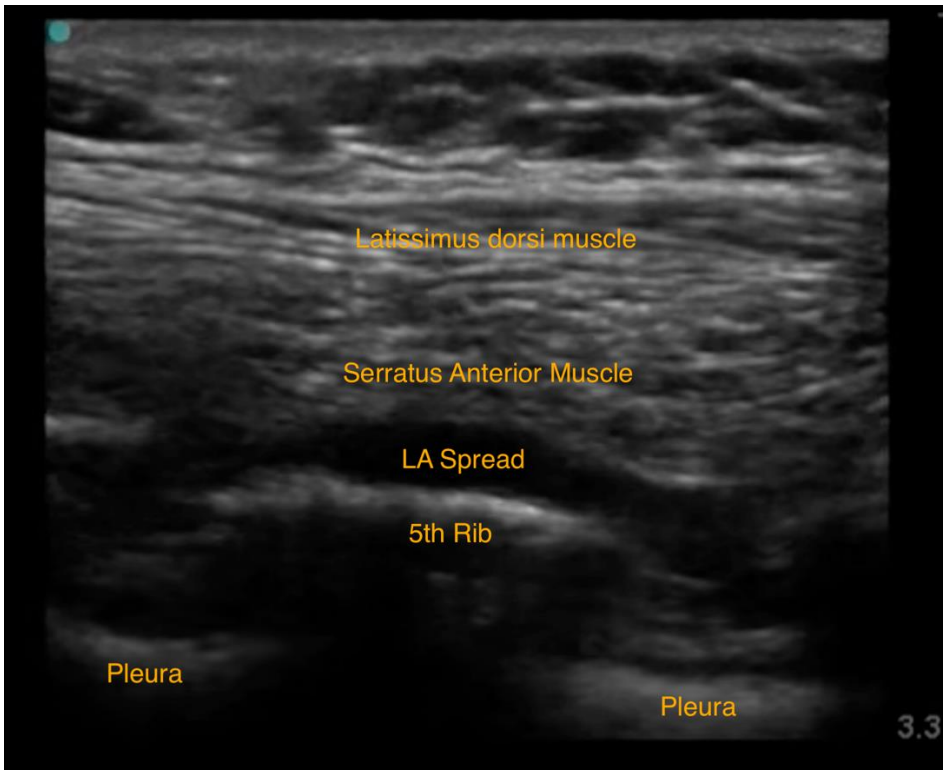

Figure 1: Serratus anterior plane block with the spread of the local anaesthetic agent.

Statistical analysis

The data was coded and entered to Microsoft Excel spreadsheet. All the statistical analyses were performed by using SSPS 22.0 software package (SSPS Inc., Chicago, IL, USA). Quantitative variables were analysed with independent t-test while qualitative variables were analysed with the Chi-Square test. A p-value less than 0.05 was considered statistically significant.

Results

The mean age for Group 1 was 24.27±7.106 years and 22.47±4.340 years for in Group 2 (p =0.41). Fourteen patients in Group I and all the 15 patients in Group II belonged to ASA class I while only one patient in Group I belonged to ASA II (p = 0.53). The BMI distribution showed that 6.6 % of the patients in Group I were overweight (BMI > 25-29.9 kg/m^2) compared to 13.3 % in Group II. In Group I, there were more patients with bilateral gynaecomastia (80%)

compared to 73.3% in Group II. Comparison of the above demographic profile was statistically non-significant (p = 0.82). The ease of needle placement was recorded as easy in 86.6% of the patients in Group I and 93.3% of the patients in Group II (p = 0.44).

The time taken to apply the block in Group I was 9.45±1.26 minutes in bilateral cases and 4.89±1.47 minutes in unilateral cases whereas the time taken to apply the block in Group II was 19.44±5.86 minutes in bilateral cases and 11.39±4.1 minutes in unilateral cases. The time taken to apply the block was significantly lower in Group I compared to Group II (p = 0.01).

VAS pain assessment showed that the pain score at different time intervals (on arrival at PACU, 30 minutes, 12 hours, and 24 hours) were slightly higher in Group I with values of 1.06, 0.73, 2.33, and 2.93 compared to Group II with values of 0.93, 0.66, and 1.87 and 2.40 respectively (p = 0.83, 0.86, 0.55 and 0.17 respectively). The pain scores at 1hour and 2 hours were higher in Group II with values of 0.67 each whereas the pain scores in Group I were lower with values of 0.53 each at 1 hour and 2 hours. However, these differences were not statistically significant (p = 0.66 and 0.66 respectively). At 6 hours and 18 hours, the pain scores were similar with values of 1.40 and 3.93 respectively. D-VAS showed that pain score on arrival at PACU, 12 hours, and 24 hours were slightly higher in Group I with values of 1.16, 2.73, and 3.11 respectively compared to Group II with values of 0.99, 2.01 and 2.79 respectively (p = 0.53, 33 and 0.53 respectively). The pain scores at 30 minutes, 1hour, 2 hours, and 6 hours were higher in Group II with values of 0.86, 0.69, 0.67 and 1.59 compared to 0.81, 0.59, 0.53 and 1.49 respectively in Group I. The differences were also not statistically significant ((p = 0.88, 0.69, 0.57 and 0.43 respectively) (Figures 2 and 3).

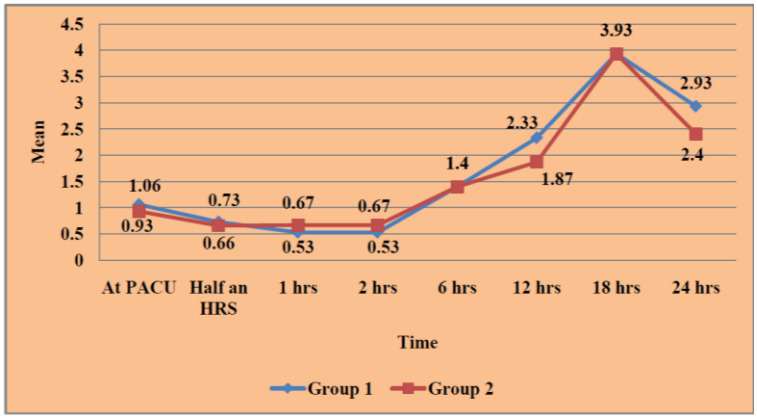

Figure 2: VAS Score at different time intervals

Paracetamol requirements at PACU on arrival, 30 minutes, 12 hours, 18 hours, and 24 hours were marginally higher in Group I with values of 13.3%, 66.0%, 46.7%, 40.0% and 26.7% in comparison to 6.6%, 0.0%, 40.0%, 33.3% and 20% respectively in Group II. These differences were not statistically significant (p = 0.33, 0.67, 0.84, 0.36 and 0.73 respectively). At 6 hours, analgesic requirement was recorded in 26.7% of the patients in Group I and in 33.3% of patients in Group II (p = 0.56). Intravenous tramadol was only required in one patient at 30 minutes and in two patients at 18 hours in Group 1 compared to three patients at 18 hours in Group II (p = 0.76). The mean duration of analgesic effect after block application was 10.25 hours (615 minutes) in Group I and 11.78 hours (706 minutes) in Group II (p = 0.73). PONV was recorded in 2 patients on

arrival at the PACU, in 1 patient at 30 minutes and in one at 18 hours in Group I whereas in Group II, PONV occurred in one patient on arrival at PACU and in two patients at 18 hours (p = 0.33 and 0.33 respectively).

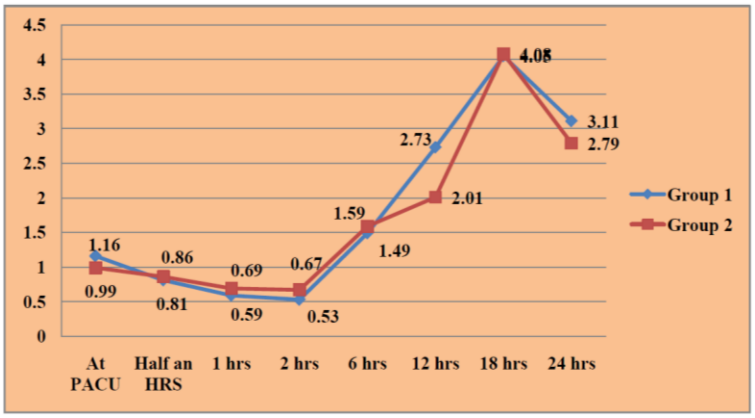

Figure 3: DVAS score at different time intervals

Discussion

The mean age of the patients requiring surgery for gynaecomastia in the present study was similar to findings in a few other studies. [14, 15] Although gynaecomastia in adolescent males is associated with obesity, most of patients in our study were non-obese. [16] Most cases of gynaecomastia are bilateral and in the present study also, a higher number of gynaecomastia cases were bilateral. [17] The ease of performing the block procedure was better in the ultrasound-guided group compared to the anatomical landmark-guided group and this difficulty, notably occurred with obese patients. [18] The time taken for ultrasound-guided SAP block was longer than that of anatomical landmark-based technique due to time consumption in preparation of transducer in a sterile way and identification of various structures while performing the block procedure. VAS score at rest at different time interval was comparable and similar between both groups.

The observations about the ultrasound-guided group in the present study were similar to the reports of Semyuonov *et al.*, in which VAS score with values of 0.0, 2.94, 2.11, 3.04, 3.32, 3.83 and 3.53 on arrival at the PACU, 30 minutes, 1 hour, 4 hours, 8 hours, 12 hours and 24 hours respectively in patients who received SAP block after thoracoscopy. [9] In the present study, D-VAS scores were almost similar among both groups but the pain scores at 30 minutes, 1 hour, 2 hours, and 6 hours were insignificantly higher in the ultrasound-guided group. These observations were comparable to the study of Baytar *et al.* [19] Semyonov *et al.* reported that the patients who received ultrasound-guided SAP block had significantly lower VAS score during the first eight postoperative hours than the patients in the control group. From the nineth hour onwards, there performances in both groups were comparable. [9] In present study, VAS scoring was lower up to six hours in both groups and the results are comparable with previous reports. In the present study, VAS, D-VAS scores and analgesics requirement in both groups were comparable. Most of the patients studied were pain-free and did not require additional analgesics up to six hours in both groups except two patients in the landmark-guided group and one patient in the ultrasound-guided group required analgesics on arrival at

the PACU. The patient who required analgesics immediately on arrival at the PACU were those in whom needle placement was found to be difficult due to obesity.

Twenty doses of rescue analgesic with intravenous paracetamol were required over different time intervals in Group I while 20 doses were required in Group II. The pattern of requirements for additional analgesics in the present study are similar to the reports by Taxak *et al.* [20] The mean duration of postoperative analgesia following the SAP block in both groups in the present study show that SAP block provides a long-lasting postoperative analgesia. This block technique effectively blocks the surgical site which is innervated by lateral cutaneous branches of the thoracic intercostals nerves which arises from anterior rami of thoracic spinal nerves and run inferiorly to each rib. Local anaesthetic agents administered in these planes spread throughout the lateral chest wall resulting in paraesthesia of the dermatomes of the anterolateral thorax. [19] The pain relief in majority of the patients was prolonged and effective majority of the patient were free from complication like PONV.

Conclusion

The observed patterns of VAS and DVAS pain score, duration of postoperative analgesia, as well as the rate of complications among both groups were comparable. It is concluded that anatomical landmark-based serratus anterior plane block is comparable in analgesic efficacy and duration as that of ultrasound- guided SAP block. Both techniques provide significant analgesia, lesser use of rescue analgesics and lesser side effects. The use of anatomical landmark-guided technique is less time consuming, with an easy learning curve and can be used easily in institutions where ultrasound facilities are not readily available. We also propose that more studies are required to further establish the effectiveness and other possible uses of anatomical landmark-based technique.

Limitation

Anatomical landmark-based SAP block poses a risk of deep puncture and pneumothorax, though none of such was recorded in the present study. However, further studies with larger sample size are needed in this regard.

Authors' Contributions: All the authors participated in the study conception, design, literature review, data analysis and interpretation, drafted the manuscript and revised the draft for sound intellectual content. All the authors read and approved the final version of the manuscript.

Conflicts of interest: None

Funding: Self-funded.

Publication History: Submitted 17 October 2023**; Accepted** 11 December 2023**.**

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