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Original Research Article

Dexmedetomidine versus dexamethasone as adjunct to ropivacaine in erector spinae plane block for patients undergoing breast surgery: a randomized, prospective, double blinded study

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ABSTRACT

Background: Loco-regional anaesthesia (GA) has been extensively applied in the clinical field for achieving post-operative analgesia. Erector spinae plane block (ESPB) which is a novel inter-fascial plane block has been widely used for breast surgery. Dexmedetomidine and dexamethasone as an adjunct to local anaesthesia have been widely reported to reduce postoperative pain and analgesic consumption but there are no studies comparing both these drugs in ESPB for breast surgery.
Methods: Sixty ASA I-II patients scheduled for breast surgery were randomly allocated into two groups-Group DX and group DM. Group DX received 20 ml ropivacaine 0.2% with dexmedetomidine 0.5 mcg/kg while group DM received 20 ml ropivacaine 0.2 % with 8 mg dexamethasone in ESPB preemptively. All the patients were induced with standard GA and extubated at the end of surgery. In the post-operative period visual analogue scale (VAS) pain score, total tramadol consumption, time for first rescue analgesia and side effects were noted for 24 hours.
Results: The demographical parameters were comparable between both the groups. The VAS score, total tramadol consumption and time for first rescue analgesia were both similar in both the groups without any significant difference. No side effects were noted in any patients in both the groups.
Conclusions: Dexmedetomidine (0.5 mcg/kg) and dexamethasone (8 mg) as an adjunct to ropivacaine reduces postoperative pain and analgesic consumption with no significant difference when used in ESPB for patients undergoing breast surgery without any side effects.

Keywords: Dexmedetomidine, Dexamethasone, ESPB, Regional anaethesia

INTRODUCTION

Breast cancer is the most common cancer in India which accounts for 13.5% cases in both the sexes and 26.3% in females among all the cancers as per report in 2020.[1] The surgical management of breast cancer includes mastectomy or breast conservation surgery (BCS). Achieving postoperative analgesia in breast surgery is of utmost importance for patient comfort, better surgical outcome, rapid recovery, early discharge and to decrease chronic pain.[2]

ESPB is an inter-fascial block first described by Forero et al in 2016 for treatment of thoracic neuropathic pain.[3] Since then ESPB has been used for achieving perioperative analgesia for various surgeries including breast surgeries, spine surgeries, cardiothoracic surgeries etc. which showed better overall post-operative outcome.[4,5] Use of various adjuncts with local anesthetics in ESPB for block prolongation and postoperative analgesic consumption has also been widely applied in clinical practice.

Dexmedetomidine, a selective alpha-2 agonist, has sympatholytic, analgesic, anxiolytic and sedative properties. It has shown to prolong analgesia when used in neuraxial and peripheral nerve blocks.[6] Dexamethasone which is a glucocorticoid with anti-inflammatory properties, widely used as antiemetic has also been in practice as adjunct to LA for regional anaesthesia for a long time.[7] Both dexmedetomidine and dexamethasone have been used as additive in regional anaesthesia resulting in block prolongation, reduced postoperative analgesic consumption particularly opioids with minimal side effects. Considering the properties of both dexmedetomine and dexamethasone as additive to local anaesthetics, we conducted this study to compare both these drugs co administered with ropivacaine as a single shot ESPB given preemptively in patients undergoing breast surgeries in terms of postoperative pain score, time of first rescue analgesic, total analgesic consumption and side effects.

METHODS

The present study was conducted in the department of onco-anaesthesia, State cancer institute, Guwahati medical college after getting approval by institutional ethics committee from April 2020 to April 2021. It is a randomized, double blinded, prospective study conducted on 60 ASA class I-II patients, randomly allocated and divided into two groups-Group DX and group DM, applying simple randomization using the sealed envelope technique. The inclusion criteria are patients aged 18-65 years undergoing breast surgery. The exclusion criteria were: patient refusal, any known allergy to study drugs, pregnant or lactating patients, any coagulation disorders, bradycardia (heart rate <60/min), uncontrolled diabetes, severe cardiopulmonary disease or psychiatric disorder. All the patients enrolled for the study were explained about the procedure and proper written and informed consent was taken. The procedure was performed by an experienced anesthetist trained in ultrasound guided regional block not involved in any analysis or data collection. Blinding was maintained throughout the intraoperative as well as postoperative period.

After explaining the procedure to the patients and teaching them about the VAS pain score assessment, proper informed and written consent was taken. The patient was then taken to the operation room (OR), standard monitors viz. non-invasive blood pressure (NIBP), electrocardiogram (ECG), SpO_2 and an intravenous (IV) line was attached. All the patients were placed in sitting position for block placement. Under all aseptic precaution ESPB was performed under ultrasound guidance at T5 level (Figure 1 and 2). Group DX received 20 ml ropivacaine (0.2%) with 0.5 mcg/kg dexmedetomidine and group DM received 20 ml ropivacaine (0.2%) with 8 mg dexamethasone. All the patients received the same anaesthesia and analgesia as per standard protocol. Patients were given standard GA with IV fentanyl l 2 mcg/kg, IV propofol 2-2.5 mg/kg and neuromuscular blockade achieved with IV vecuronium 0.1 mg/kg. Trachea was secured with appropriately sized endotracheal tube (ETT). Intraoperatively anaesthesia was managed with O_2:N_2O=50:50 and isoflurane 0.8-1%. IV paracetamol 1 gm and IV ondansetron 4 mg were administered intraoperatively. At the end of surgery neuromuscular blockade was reversed and trachea extubated.

All the patients were sent to post-operative care unit (PACU) for further monitoring and followed up for 24 hours. In the postoperative period VAS pain score was noted at 0, 2, 6, 12 and 24 hours. All the patients received IV paracetamol 1 gm 8 hourly as per standard protocol. IV tramadol 50 mg was given as rescue analgesia when VAS>4. The time for first rescue analgesic and total analgesic consumption was recorded at the end of postoperative 24 hours. Any side effects noted in the postoperative 24 hours were noted.

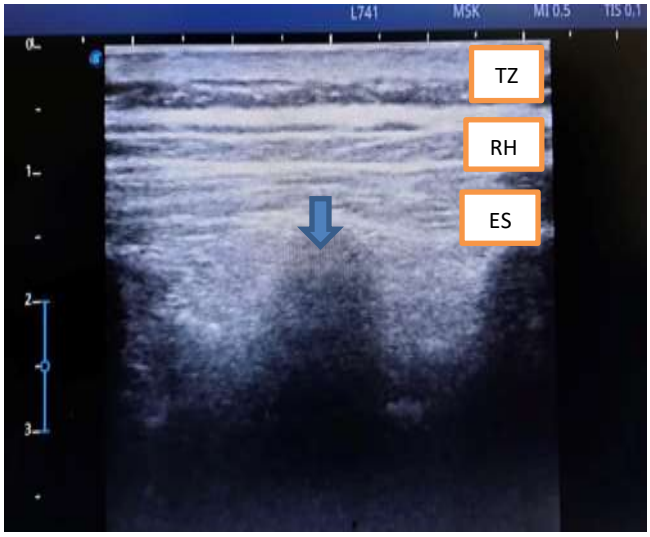

Figure 1: Ultrasound image of T5 transverse process (arrow) and the three muscle layers (TZ-trapezius, RH-rhomboids, ES-erector spinae).

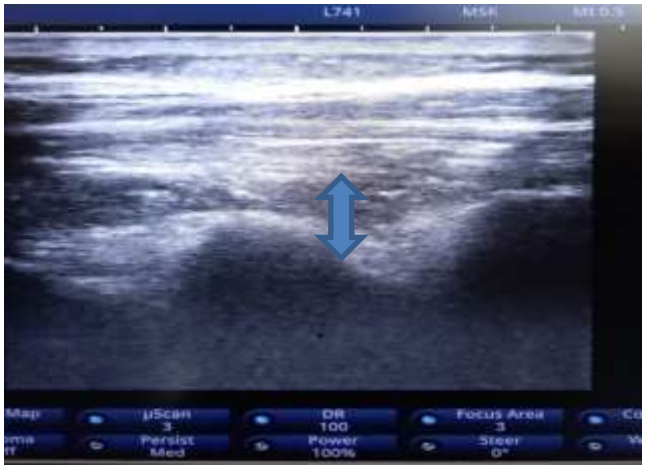

Figure 2: Drug spread deep to the erector spinae muscle.

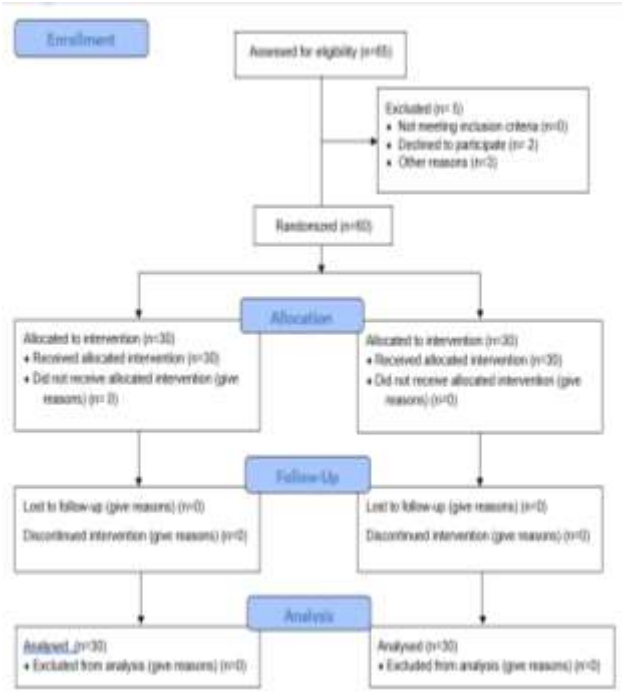

Figure 3: CONSORT flow diagram of study.

Statistical analysis

Statistical analysis of recorded parameters was performed by the SPSS (Statistical package for the social sciences) program for windows, version 21.0. Continuous variables were expressed as mean ± SD. Comparisons of normally distributed continuous variables between the groups were performed using I t-test, while non-normally distributed continuous variables between the groups were compared using the Mann-Whitney U test. Comparisons of categorical variables between the groups were performed using Fisher's exact test and chi-square test. Kolmogorov-Smirnov and Shapiro-Wilks's test was applied to test for normality of characteristics between the two groups. For all statistical tests, a p value is less than 0.05 was taken to indicate a significant difference at 95% confidence interval.

RESULTS

The demographic parameters, duration and type of surgery of all patients of two groups were comparable without any significant statistical difference (p>0.05) (Table 1 and 2). The HR, SBP, DBP and MAP in both the groups in the post-operative period were not statistically significant. The VAS pain score at all the time points in the post-operative period for both the group were not significant and the median VAS was 2 for both the groups. The VAS at 0 hours for group DX was 1.8±1.3 and group DM was 1.8±1.5 while at 24 hours it was 2.2±1.24 for group DX and 1.83±1.21 for group DM (Table 3 and Figure 4).

Total tramadol consumption in group DX was 54.55±15.08 mg and group DM was 50±0.00 mg which was statistically not significant. The time for first rescue analgesia for group DX (409.5±276.3 min) was less than group DM (740±575.1 min), although it was statistically not significant as shown in the Table 4. No side effects like bradycardia, sedation, nausea or vomiting were noted in any patients.

Table 1: Demographic parameters, duration of surgery.

Variables	Group DX, (n=30)	Group DM, (n=30)	P value
Age (years)	50.1±8.75	47.23±8.32	0.1990
Weight (kg)	52.77±7.11	56.37±8.41	0.0780
Duration of Sx (min)	168±34.76	154 ± 36.2	0.137

Table 2: Types of surgery.

Surgery	Group DX (%)	Group DM (%)	Total (%)	Chi	P value
BCS	7 (23.3)	3 (10.0)	10 (16.7)		
Lumpectomy	1 (3.3)	2 (6.7)	3 (5.0)	2.125	0.346
MRM	22 (73.3)	25 (83.3)	47 (78.3)		

DX-dexmedetomidine, DM-dexamethasone, BCS-breast conservation surgery, MRM-modified radical mastectomy.

Table 3: VAS at different time point of both the groups.

VAS (Hours)	Group DX		Group DM		P value
	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	
0	1.8±1.3	2 (1-2)	1.87±1.55	2 (1-2)	0.848
2	2.57±1.7	2 (2-3)	1.87±1.17	2 (1-2.25)	0.145
6	2.23±0.9	2 (2-2.25)	2.07±1.08	2 (2-2.25)	0.586
12	2.13±0.63	2 (2-2)	2.17±1.58	2 (1-3)	0.603
24	2.2±1.24	2 (2-2.25)	1.83±1.21	2 (1-2)	0.236

Table 4: Total tramadol consumption and time for first rescue analgesia of both the groups.

Variables	Group DX	Group DM	P value
Total tramadol consumption (mg)	54.55±15.08	50.00±0.00	0.134
Time for first rescue (min)	409.5±276.3	740.0±575.1	0.46

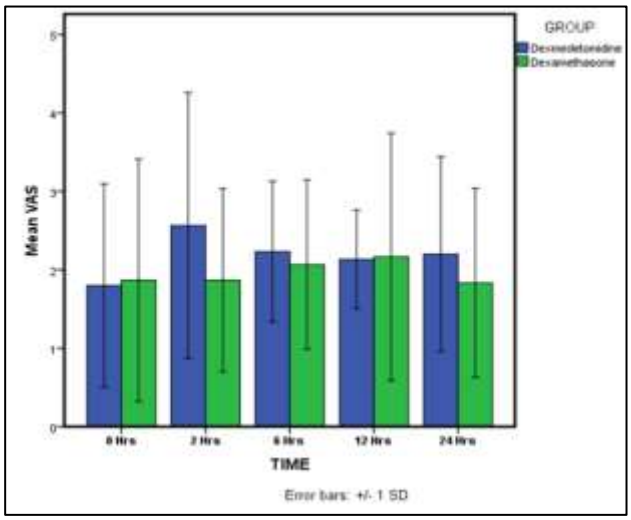

Figure 4: Mean VAS of both the groups.

DISCUSSION

Ferero et al introduced ESPB, which is a truncal inter-fascial block for treatment of thoracic neuropathic pain in 2016, and since its introduction this block has been widely used for postoperative pain management in different kinds of surgeries.[3] ESPB which is mostly performed under ultrasound guidance aims to deposit the drug deep to the erector spinae muscle. The mechanism by which it acts is believed to be a compartmental spread where the LA diffuses anteriorly to block the ventral and dorsal spinal rami; and also believed to reach the paravertebral space through intertransverse connections.[8] Studies has shown that a 20 ml volume spreads craniocaudally up to 7 to 9 vertebral spaces.[9,10] In our study, we deposited 20 ml volume of drug at T5 level which will cover T1-T9 dermatome needed for breast surgery.

ESPB along with GA has been used in various surgeries as a part of multimodal analgesia regime to achieve postoperative analgesia.[11-14] The addition of additive to LA in ESPB further prolongs the block and provides better quality of analgesia in the postoperative period. Dexmedetomidine which is a centrally acting alpha 2 agonist is used for its anxiolytic, sedative and analgesic properties. When it is used in nerve block studies have shown that it acts peripherally to block the hyperpolarization cation current.[15] Its addition in central neuraxial blocks and various nerve blocks has shown to decrease block latency, increase duration of motor block and period of analgesia.[16-18] Wang et al found that ropivacaine with dexmedetomidine in ESPB for modified radical mastectomy (MRM) was found to decrease VAS and analgesic consumption in the postoperative period when compared to plain ropivacaine without any adjunct.[19] Similar to dexmedetomidine, dexamethasone has also been in used in regional anaesthesia as additive for a very long period of time.[20] Dexamethasone which is a glucocorticoid exerts its action by decreasing perineural edema, decreasing systemic absorption of LA by inducing vasoconstriction and directly acting on nerves to reduce neural discharge and suppressing pain signal transmission.[21] Dexamethasone combined with ropivacaine has shown to prolong block and duration of analgesia when used for various regional blocks. Fusco et al reported decrease pain intensity and opioid consumption when dexamethasone was used as an adjuvant with LA for bilateral ESPB.[22]

Dexmedetomidine has been used in a dose range of 0.5-2 mcg/kg in regional blocks.[23,24] Studies have reported good analgesic effect with this dose range, although few studies reported bradycardia, hypotension and sedation with dose of 1-2 mcg/kg.[25,26] So we stick to the dose of 0.5 mcg/kg which resulted in good postoperative analgesia with median VAS of 2. None of the patients in our study had bradycardia, hypotension or sedation in the intraoperative or postoperative period. Dexamethasone 8-10 mg has been the most common dose used for regional blocks.[27] It has shown to prolong the block with the major advantage being few to none perineural toxicity.[28]

In our study dexamethasone 8 mg with 0.2% ropivacaine has shown similar results like dexmedetomidine 0.5 mcg/kg with 0.2% ropivacaine when used in ESPB for postoperative analgesia in patients undergoing breast surgery. Gao et al did similar study comparing dexmedetomidine and dexamethasone as adjuvant with ropivacaine for ESPB in patients undergoing thoracotomy, where they reported better analgesic outcome and decrease analgesic consumption with dexmedetomidine when compared to dexamethasone group.[29] However, they used higher doses than our study where they compared dexmedetomidine 1 mcg/kg with 10 mg dexamethasone as adjunct to ropivacaine.

In our study we also observed that out of total 17 patients complaining of pain (VAS>4) in both the groups 12 patients complained of pain in the axillary area whereas no pain was there in the anterior chest wall, which might be due to sparing of dermatomes supplying the axillary area. A higher cephalad spread might have been achieved by injecting a higher volume of drug or by attaining a higher dermatomal level of block. However, it needs to be mentioned that we cannot speculate that inadequate cephalad spread of the drug was the sole reason for this inadequate coverage.

We found that there was no significant difference in total analgesic consumption and the demand for first rescue analgesia between the dexmedetomidine and dexamethasone group. Studies have shown to reduce the analgesic consumption and increase the analgesic demand time with both dexmedetomidine and dexamethasone when used as adjunct to LA.[30,31] But in our study the time for first rescue analgesia was rather less with dexmedetomidine when compared to dexamethasone, although it was not statistically significant.

Hypotension, bradycardia, sedation is some of the commonly known side effects with dexmedetomidine, although it is reported only with higher doses when used in regional anaesthesia.[32] On the other hand dexamethasone when used perineurally has shown to cause almost no side effects. In our study no such side effects were reported in any patients in both the groups.

Limitations of our study includes non-uniformity of the type of surgeries and ESPB was not assessed clinically via pinprick/temperature sensation but was rather confirmed by the spread of drug in USG image. Since this is the only study (by best of our knowledge) comparing both these agents for ESPB in patients undergoing breast surgery, a multicentric study involving a larger number of patients will help to establish our findings.

CONCLUSION

Dexmedetomidine (0.5 mcg/kg) and dexamethasone (8 mg) as an adjunct to ropivacaine reduces postoperative pain and analgesic consumption with no significant difference when used in ESPB for patients undergoing breast surgery without any side effects.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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