Original Article

Effects of fentanyl and dexmedetomidine as adjuvants to bupivacaine in paravertebral block for postoperative analgesia in patients undergoing modified radical mastectomy: A prospective randomised double-blind study

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ABSTRACT

Background and Aims: Paravertebral block (PVB) is an established method, indicated for postoperative analgesia after modified radical mastectomy (MRM). Although many additives to bupivacaine in PVB have been tried to prolong the analgesia in postoperative period, no additive has been found without any adverse effects. We have compared the duration of analgesia in PVB using adjuvants like dexmedetomidine and fentanyl with bupivacaine after MRM. **Methods:** A total of 60 female patients enroled for MRM were divided into two groups of 30 patients each. Group BF received PVB with 20 ml bupivacaine 0.25% with fentanyl 1 μg/kg and group BD received 20 ml bupivacaine 0.25% with dexmedetomidine 1 μg/kg for PVB. After confirming successful PVB, surgery was done under general anaesthesia. Time for first rescue analgesic request was the primary outcome of the study. The secondary outcome was comparison of visual analogue scale scores for pain and total analgesic consumption. Side effects like sedation, nausea, vomiting, bradycardia and hypotension in the postoperative period till 24 h were also assessed. **Results:** The time for first rescue analgesic request was 6.32 ± 1.75 h in the BD group contrary to 3.94 ± 2.12 h in group BF ($P < 0.05$). Total paracetamol consumed as rescue analgesia in the first 24 h of postoperative period was remarkably reduced in group BD (1.7 ± 0.94 gm) in contrary to group BF (2.6 ± 0.98 gm) ($P < 0.05$). There was no significant difference in the incidence of complications between the groups. **Conclusion:** Dexmedetomidine provides prolonged postoperative analgesia compared with fentanyl when used as an adjuvant to bupivacaine in PVB after MRM.

Key words: Analgesia, dexmedetomidine, fentanyl, paravertebral, postoperative

INTRODUCTION

Breast cancer is the most common cancer in women which usually requires modified radical mastectomy (MRM).[1] This is commonly performed under general anaesthesia and 40% of breast cancer surgery patients complain of remarkable acute postoperative pain which is controlled with the use of intravenous (IV) analgesic agents. IV analgesic agents are associated with a high occurrence of

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postoperative nausea and vomiting (PONV).[2] This can lead to poor recovery and increase in the duration of hospital stay. So, to avoid these problems, the use of IV analgesic agents needs to be minimised. Various regional techniques like intercostal block, epidural analgesia, paravertebral block (PVB) and pectoral nerve block have been suggested for postoperative pain management, but have shown variable efficacy. In a retrospective cohort study, authors concluded that PVB reduces postoperative pain score, total opioid consumption, complications like PONV and length of hospital stay in oncoplastic breast surgery.[3] PVB has been also found to be associated with enhanced recovery after microvascular breast surgery.[4] Various adjuvants like fentanyl, clonidine, magnesium sulphate and dexamethasone have been used with bupivacaine for prolonging the duration of the analgesia in PVB.[5] But, as the literature is silent about the ideal adjuvant to local anaesthetics, the search for an adjuvant with a good analgesic profile and less adverse effects continues. Dexmedetomidine has evolved as *a drug for all seasons,* in the current practice scenario.[6] Dexmedetomidine has proven its efficacy as an adjuvant to bupivacaine in PVB where it provides a significant clinical benefit by decreasing the postoperative use of analgesics, and prolonging the onset of postoperative analgesic requirement compared with morphine. It has also been reported to produce a remarkable decrease in pulse rate and mean arterial blood pressure intraoperatively.[7] Fentanyl as an additive to 0.25% bupivacaine in PVB has been found to reduce the rescue analgesic consumption as well as cumulative pain scores at rest and on movement after breast surgery but it has not been much studied.[8] Our aim was to compare the efficacy of additives like fentanyl and dexmedetomidine when used with bupivacaine in PVB for postoperative analgesia and also to study any associated complications in the postoperative period after MRM.

METHODS

This prospective randomised study was undertaken at a tertiary care hospital from February 2021 to July 2021 after taking Institutional Ethics Committee approval and registering in the Clinical Trials Registry—India (CTRI/2021/02/031164). All the principles of the Declaration of Helsinki were followed during the course of the study. All patients confirmed their willingness and signed the informed consent form. A total of 60 patients of American Society of Anesthesiologists physical status I and II of age 18 to 70 years posted for MRM were enroled in this study. Patients having coagulopathy, allergy to study drug, infection at the site of PVB, pregnancy and severe cardiopulmonary diseases were excluded from the study. During pre-anaesthetic check-up, after taking history, all the patients were examined and investigations were checked. All the patients were informed regarding the interpretation of visual analogue scale (VAS, 0-10).[9] Patients were randomly allocated into two groups (group BF and group BD) using a computer-generated random number table and the codes were kept in a sealed opaque envelope. The study drug was prepared by an anaesthesiologist not involved in the study. Both the patients and the investigator involved in the collection of data were blinded to allocation. After entry into the operating theatre, IV access was established through an 18 gauge IV cannula and ringer's lactate 10 ml/kg was started. Heart rate (HR), non invasive blood pressure (NIBP), peripheral oxygen saturation (SpO_2), and temperature were monitored. Midazolam 0.03 mg/kg IV and tramadol 1 mg/kg IV were given as premedication. Ultrasound-guided thoracic PVB was performed at level T4 with the patients in sitting position using longitudinal oblique in-plane approach. A high-frequency transducer probe (8–12 MHz) connected to an ultrasound machine (GE Logiq F™ -General Electric Healthcare, Little Chalfont, United Kingdom) was positioned in a para-median sagittal plane, approximately 2.5 cm lateral to the spinous process at the ipsilateral side of the location of surgery. Using a 26-gauge needle, the skin and subcutaneous tissue was infiltrated with 5 ml of 1% lignocaine. Ultrasound probe was used to locate the paravertebral space and a 22 gauge, 50 mm blunt insulated nerve block needle (B. Braun Medical Inc., Bethlehem Pennsylvania) was introduced in an in-plane direction from caudad to cephalad [Figure 1]. After perforating the superior costotransverse ligament and confirming negative aspiration of blood, 20 ml of allocated drug was injected. The correct placement of the study drug was confirmed by expansion of the paravertebral space between the pleura and superior costotransverse ligament. Anterior movement of the pleura indicated appropriate spread of drug. In group BF, patients received 20 ml of bupivacaine 0.25% with 1 μg/kg fentanyl for PVB. In group BD, patients received 20 ml of bupivacaine 0.25% with 1 μg/kg dexmedetomidine for PVB. Success of the block was evaluated using the pinprick test at T1–T6 dermatome 20 min after the block in sitting position. Failure of

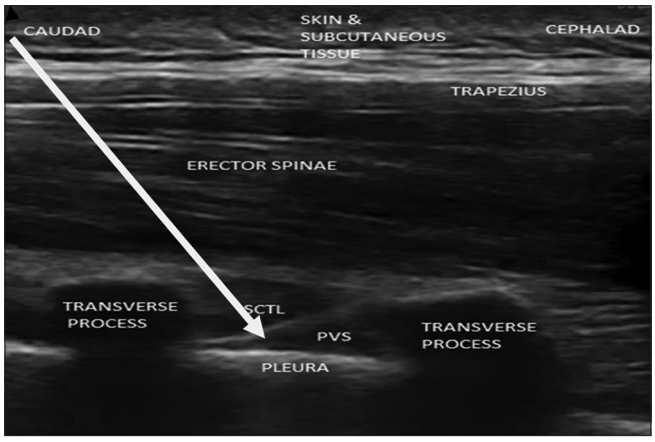

Figure 1: Sonographic image showing technique of paravertebral block with needle path. *SCTL: Superior costotransverse ligament, PVS: Paravertebral space

PVB was considered if loss of pinprick sensation was delayed more than 30 min in same dermatomes. Patients with failed block were excluded from the analysis. All the patients with successful block were then made supine and surgery started. Baseline parameters like SpO_2, NIBP and HR were recorded and monitored continuously. Tramadol 1 mg/kg IV was administered and induction was done with propofol 2 mg/kg IV and endotracheal intubation was done using rocuronium 0.6 mg/kg IV and the patients were maintained with oxygen, nitrous oxide and isoflurane 1% to 1.5%. Anaesthesia was deepened by increasing the percentage of isoflurane when mean arterial pressure (MAP) increased by 20% over pre-induction value. Reduction of MAP more than 20% below baseline value was taken as hypotension which was managed by reducing isoflurane concentration and administering ephedrine 5 mg IV. HR <50 beats/min was considered as bradycardia. At the end of the surgery, the residual neuromuscular block was reversed using glycopyrrolate 10 μg/kg and neostigmine 50 μg/kg IV. After extubation, all the patients were shifted to the post anaesthesia care unit where vital parameters were recorded. VAS at rest and on ipsilateral arm abduction movement was monitored at 0, 2, 4, 6, 12 and 24 h postoperatively. Paracetamol 15 mg/kg IV was administered when the VAS was ≥4. Sedation score assessed by Ramsay sedation scale, haemodynamic parameters (HR and MAP) and complications such as hypotension, bradycardia, respiratory depression, pruritus, nausea and vomiting in the postoperative period were recorded. Ondansetron (4 mg) IV was given to all patients with nausea, retching or vomiting. The primary objective was to compare time for the first rescue analgesic request, while the secondary objectives were to compare total analgesic consumption and VAS at rest and on movement at different time points. Sample size was calculated after doing a pilot study among 10 patients with time for first analgesic request as the primary outcome of the study. Time to first analgesic request was 3.51 ± 1.13 h in bupivacaine-fentanyl group and 5.92 ± 1.15 h in bupivacaine-dexmedetomidine group. With α error of 0.05 and power of the study (1 − β) at 80%, to detect at least 120 min variation in time for first analgesic request among the two groups, the sample size was calculated to be 28 in each group; 30 patients were enroled in each group to make up for any dropouts. Data were entered in a Microsoft excel spreadsheet and analysed using statistical package for the social sciences version 21. Shapiro–Wilk test was used for checking the normality distribution of the variables. The patients' demographic data and pain profile were analysed using the Student's unpaired t-test and Chi-square test appropriately. *P* value <0.05 was taken as statistically significant.

RESULTS

Totally 65 female patients undergoing MRM were enroled for the study, and 5 patients were excluded for not fulfilling the inclusion criteria. PVB was successful in all the enroled patients [Figure 2]. Patient characteristics like age, gender, weight and duration of surgery between the two groups were equivalent [Table 1]. The request for first rescue analgesia was significantly earlier in group BF (3.94 ± 2.12 h) compared with Group BD (6.32 ± 1.75 h) [*P* value 0.014]. The mean paracetamol consumption during 24 h postoperatively was significantly reduced in group BD (1.7 ± 0.94 gm) compared with group BF (2.6 ± 0.98 gm) [*P* value 0.029] [Table 2]. VAS scores at rest were low up to 4 h in group BD in comparison to group BF, the difference being statistically not significant. But during the 4 to 12 h interval, VAS scores at rest were significantly low in group BD in comparison to group BF [Figure 3]. Variation in VAS scores on movement in both study groups was not significant [Figure 4]. Intra operatively, between 30 and 90 min, HR and MAP were reduced more in group BD compared with group BF which was statistically significant. HR and MAP in the postoperative period in both the groups were comparable. Sedation scores in group BD and BF were 1.5 ± 0.5 and 1.4 ± 0.3, respectively, at first hour of the postoperative period which was not significant. Also, there were no remarkable differences in sedation scores

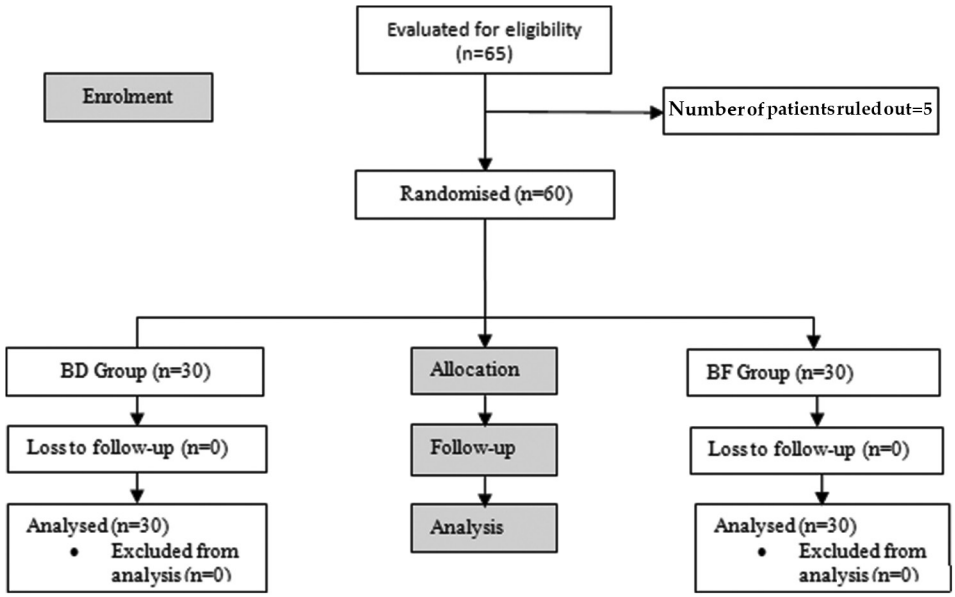

Figure 2: Consolidated Standards of Reporting Trials (CONSORT) flow diagram

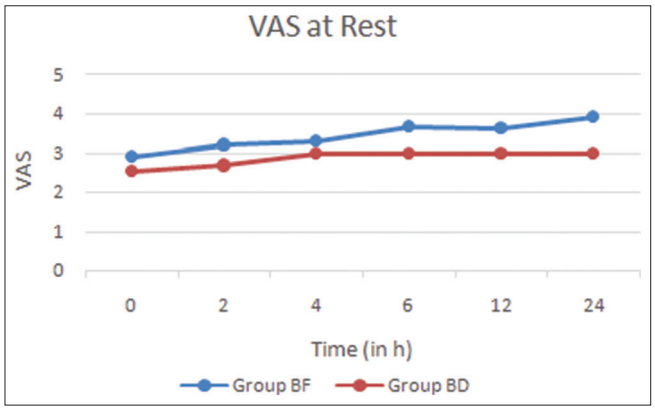

Figure 3: Visual analogue scale (VAS) score on rest

at 6 and 12 h and number of patients having sedation among the two groups [$P > 0.05$]. Regarding other complications seen in the first 24 h postoperatively, four patients in group BD and five patients in group BF had PONV, the difference not being statistically significant. Also there was no remarkable variation in the incidence of complications like bradycardia and hypotension between the two groups [Table 2].

DISCUSSION

This study compared the efficacy of dexmedetomidine and fentanyl as adjuvants to 0.25% bupivacaine for postoperative analgesia facilitated by the use of ultrasound-guided PVB in MRM. The study showed that dexmedetomidine, as an additive to bupivacaine, in PVB delayed the first request of rescue analgesia and produced a significant reduction in the total requirement of rescue analgesia in the first 24 h postoperatively compared with fentanyl. Dexmedetomidine produced a remarkably low postoperative VAS score between 4 and 12 h with less incidence of nausea and vomiting postoperatively compared with fentanyl. PVB is commonly used to induce unilateral analgesia along the thorax and the abdomen without severe haemodynamic changes. The benefits of thoracic PVB have been demonstrated in patients undergoing surgery for breast cancer.[10] However, pleural puncture resulting in pneumothorax is a serious complication associated with traditional approaches using guidance from anatomic landmarks and nerve stimulation, which may have contributed to the low use of this block. An ultrasound-guided technique has the potential to reduce complications by providing direct visualisation of the paravertebral space during needle manipulation.[11] Role of ultrasound in PVB is vital because an appropriately deposited local anaesthetic agent penetrates into the epidural space and blocks the spinal nerves, sympathetic chain and dorsal ramus.[12] In a study, ultrasound-guided PVB has been found to have reduced severe postoperative pain and produced higher patient satisfaction following percutaneous nephrolithotomy.[13] As per literature, various adjuvants have been used to prolong the duration of local anaesthetics in PVB. Fentanyl among opioids and dexmedetomidine among non-opioids are the commonly used adjuvants to bupivacaine in regional nerve blocks to provide prolonged analgesia. Although either fentanyl or dexmedetomidine had been used with bupivacaine in the PVB, no single

Table 1: Demographic data and duration of surgery

Parameters	Group BD (*n*=30)	Group BF (*n*=30)	*P*
Age in years (Mean±SD)	55.13±4.95	54.83±8.34	0.367
Weight in kg (Mean±SD)	52.11±8.28	53.96±8.18	0.209
Height in cm (Mean±SD)	155.18±5.21	156.19±5.36	0.214
ASA I/II [Number (%)]	18 (60%)/12 (40%)	20 (66%)/10 (33%)	0.513
BMI in kg/m^2 (Mean±SD)	22.25±2.32	22.97±2.49	0.278
Surgical time in hours (Mean±SD)	1.91±0.24	2.12±0.2	0.271

ASA: American Society of Anesthesiologists, BMI: Body mass index, SD: Standard deviation. Student's *t*-test and Chi-square test applied. *P*<0.05 is significant

Table 2: Postoperative pain characteristics and complications

Postoperative variable	Group BD (*n*=30)	Group BF (*n*=30)	*P*
Time to first analgesic request in hours	6.32±1.75	3.94±2.12	0.014
Paracetamol consumption in grams	1.7±0.94	2.6±0.98	0.029
PONV [Number (%)]	4 (13.3%)	5 (16.6%)	0.245
Bradycardia [Number(%)]	2 (6.6%)	1 (3.3%)	0.278
Hypotension [Number(%)]	3 (10%)	1 (3.3%)	0.198
Sedation [Number (%)]	3 (10%)	4 (13.3%)	0.159

Values expressed as Mean±SD, SD: Standard deviation. Student's *t*-test and Chi-square test applied. *P*<0.05 is significant. PONV: Postoperative nausea and vomiting

study ever had compared both adjuvants in the PVB after a MRM. Bhuvaneswari *et al.*,[14] in a trial of PVB for mastectomy, found that bupivacaine 0.25% + epinephrine combined with fentanyl 2 μg/ml provided excellent postoperative analgesia comparable to bupivacaine 0.5% + epinephrine but fentanyl group showed an increased incidence of nausea and vomiting. In their study, fentanyl may have contributed toward prolonged analgesia with greater incidence of nausea and vomiting which was in agreement with our study. In few other studies on PVB, the authors opined that fentanyl improved the duration of local anaesthetics, producing prolonged postoperative analgesia along with adverse effects like nausea, vomiting and pruritus.[15,16] This was similar to our study findings. These side effects may be due to the binding of fentanyl to opioid receptors, found in dorsal root ganglia. Dexmedetomidine is a potent and selective α2-adrenergic receptor agonist whose selectivity (α2:α1) ratio is 1600:1. It has shown sedative, analgesic and anaesthesia-sparing properties without any respiratory depression. It improves the postoperative pain scores and prolongs the duration of nerve block when used as adjuvant with local anaesthetics.[17] Dexmedetomidine acts centrally at the dorsal root neuron in the nociceptive pathway and inhibits the release of substance P. It stimulates the adrenergic alpha-2 receptors of the locus coeruleus and peripheral adrenergic alpha-2 receptors which leads to decrease in the secretion of noradrenaline and inhibition of nerve fibre action potential.[18] We have compared dexmedetomidine and fentanyl as an additive to bupivacaine in PVB. Studies have shown

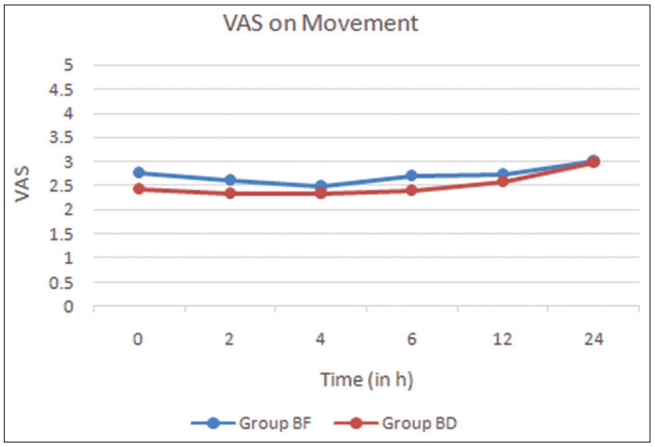

Figure 4: Visual analogue scale (VAS) score on movement

that the addition of dexmedetomidine as an adjuvant to bupivacaine produced prolonged analgesia, improved postoperative pulmonary functions and reduced the need of rescue analgesia following thoracotomy procedures, which was in agreement with our study.[19-21] The authors of a study on PVB in renal surgeries have concluded that dexmedetomidine with bupivacaine in PVB in renal surgeries provides a better analgesic profile compared with fentanyl and this is similar to our study findings.[22] But few studies have also shown opioids like morphine as a superior adjuvant to dexmedetomidine in PVB which contradicts our study findings. Several studies have reported that morphine is a better additive to bupivacaine in providing postoperative analgesia in PVB after MRM when compared with dexmedetomidine.[23,24] The researchers in these studies used a high dose (3 mg) of morphine which could have led to its superiority

over dexmedetomidine. In another study on PVB, there was a remarkable intraoperative reduction in HR and MAP in the dexmedetomidine group compared with the fentanyl group, which was in agreement with the current study.[25] Incidence of PONV was low in the dexmedetomidine group in comparison to the fentanyl group but it was not statistically significant. This difference may be due to emetic properties of opioid derivatives and anti-emetic properties of dexmedetomidine. Also, the low incidence of PONV may have been due to the opioid-sparing effect of PVB. The major strengths of our study were avoiding selection bias through randomisation and interpretation bias through double blinding. One of the limitations of our study was not collecting data regarding the effect of block on intraoperative analgesic requirements. Also, data on postoperative pulmonary complications and long-term chronic pain was not collected. As the sample size was low, future trials with larger sample size are warranted to validate the findings.

CONCLUSION

Compared with fentanyl, dexmedetomidine when used as adjuvant to bupivacaine in PVB in patients undergoing MRM not only provides prolonged analgesia but also reduces analgesic consumption 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(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Rossi L, Mazzara C, Pagani O. Diagnosis and treatment of breast cancer in young women. Curr Treat Options Oncol 2019;20:86.
2. Tripathy S, Rath S, Agrawal S, Rao PB, Panda A, Mishra TS, *et al*. Opioid-free anesthesia for breast cancer surgery: An observational study. J Anaesthesiol Clin Pharmacol 2018;34:35-40.
3. Buzney CD, Lin LZ, Chatterjee A, Gallagher SW, Quraishi SA, Drzymalski DM. Association between paravertebral block and pain score at the time of hospital discharge in oncoplastic breast surgery: A retrospective cohort study. Plast Reconstr Surg 2021;147:928e-35e.
4. Bajwa SJS, Jain D, Anand S, Palta S. Neural blocks at the helm of a paradigm shift in enhanced recovery after surgery (ERAS). Indian J Anaesth 2021;65(Suppl 3):S99-103.
5. Kirksey MA, Haskins SC, Cheng J, Liu SS. Local anesthetic peripheral nerve block adjuvants for prolongation of analgesia: A systematic qualitative review. PLoS One 2015;10:e0137312.
6. Parida S, Theerth KA. Dexmedetomidine: A drug for all seasons? Indian J Anaesth 2021;65:789-91.
7. Morsy AR, Abd-Elmaksoud MM, Abdel Aziz RA, Metwally M. Comparison between dexmedetomidine versus morphine added to bupivacaine in paravertebral block in patients scheduled for modified radical mastectomy. Res Opin Anaesth Intensive Care 2017;4:59–64.
8. Terkawi AS, Tsang S, Sessler DI, Terkawi RS, Nunemaker MS, Durieux ME, *et al*. Improving analgesic efficacy and safety of thoracic paravertebral block for breast surgery: A mixed-effects meta-analysis. Pain Physician 2015;18:E757-80.
9. McCartney CJL, Abdallah F. Pain relief and recovery after breast cancer surgery: translating best evidence into practice. Anaesthesia 2020;75:1136-8.
10. El Ghamry MR, Amer AF. Role of erector spinae plane block versus paravertebral block in pain control after modified radical mastectomy. A prospective randomised trial. Indian J Anaesth 2019;63:1008-14.
11. Pace MM, Sharma B, Anderson-Dam J, Fleischmann K, Warren L, Stefanovich P. Ultrasound-guided thoracic paravertebral blockade: A retrospective study of the incidence of complications. Anesth Analg 2016;122:1186-91.
12. D'Ercole F, Arora H, Kumar PA. Paravertebral block for thoracic surgery. J Cardiothorac Vasc Anesth 2018;32:915-27.
13. Yaman F, Tuglu D. Analgesic efficacy of ultrasound guided paravertebral block in percutaneous nephrolithotomy patients: A randomized controlled clinical study. BMC Anesthesiol 2020;20:250.
14. Bhuvaneswari V, Wig J, Mathew PJ, Singh G. Post-operative pain and analgesic requirements after paravertebral block for mastectomy: A randomized controlled trial of different concentrations of bupivacaine and fentanyl. Indian J Anaesth 2012;56:34-9.
15. Mohta M, Ophrii EL, Sethi AK, Agarwal D, Jain BK. Continuous paravertebral infusion of ropivacaine with or without fentanyl for pain relief in unilateral multiple fractured ribs. Indian J Anaesth 2013;57:555-61.
16. Hashemi SJ, Heydari SM, Hashemi ST. Paravertebral block using bupivacaine with/without fentanyl on postoperative pain after laparoscopic cholecystectomy: A double-blind, randomized, control trial. Adv Biomed Res 2014;3:187.
17. Wang K, Wang LJ, Yang TJ, Mao QX, Wang Z, Chen LY. Dexmedetomidine combined with local anesthetics in thoracic paravertebral block: A systematic review and meta-analysis of randomized controlled trials. Medicine (Baltimore) 2018;97:e13164.doi: 10.1097/MD.0000000000013164.
18. Lee S. Dexmedetomidine: present and future directions. Korean J Anesthesiol 2019;72:323-30.
19. Hong B, Lim C, Kang H, Eom H, Kim Y, Cho HJ, *et al*. Thoracic paravertebral block with adjuvant dexmedetomidine in video-assisted thoracoscopic surgery: A randomized, double-blind study. J Clin Med 2019;8:352.
20. Biçer C, Ünalan EN, Aksu R, Önal Ö, Güneş I. Addition of dexmedetomidine to bupivacaine in ultrasonography-guided paravertebral blockade potentiates postoperative pain relief among patients undergoing thoracotomy. Rev Bras Anestesiol 2019;6:144-51.
21. Hassan ME, Mahran E. Evaluation of the role of

dexmedetomidine in improvement of the analgesic profile of thoracic paravertebral block in thoracic surgeries: A randomised prospective clinical trial. Indian J Anaesth 2017;61:826-31.
22. Elsharkawy RA, Mohamed MN, Zakari MM, Othman MM.The effects of paravertebral bupivacaine-dexmedetomidine versus bupivacaine-fentanyl in unilateral open renal surgeries. SOJ Anesthesiol Pain Manag 2018;5:1-8.
23. Megha T, Hegde HV, Rao PR. Paravertebral block with morphine or dexmedetomidine as adjuvant to bupivacaine for post-operative analgesia in modified radical mastectomy: A prospective, randomised, double-blind study. Indian J Anaesth 2018;62:424-30.
24. Ahmed MJ, Ur Rehman A, Arshad RM, Amjad MWA, Khan Z, Furqan A. Efficacy of dexmedetomidine vs morphine as an adjunct in a paravertebral block with bupivacaine in postoperative analgesia following modified radical mastectomy. Cureus 2020;12:e8231.
25. Mohamed SA, Fares KM, Mohamed AA, Alieldin NH. Dexmedetomidine as an adjunctive analgesic with bupivacaine in paravertebral analgesia for breast cancer surgery. Pain Physician 2014;17:E589-98.