ORIGINAL RESEARCH ARTICLE

Role of Dexmedetomidine as Adjuvant to Bupivacaine in Ultrasonography-Guided Paravertebral Blockade in Thoracic Surgeries: A Prospective, Randomised, Double-Blind Study

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A B S T R A C T

Introduction: Thoracic paravertebral block (TPB) is one of the effective methods for management of post-operative pain in thoracic surgeries. Study aimed to find out whether addition of dexmedetomidine to continuous bupivacaine infusion via paravertebral catheter in thoracic surgeries improves the analgesic profile of paravertebral bupivacaine.

Material and Methods: 50 ASA I-II patients aged 20-60 years were included in the study and scheduled for thoracic surgery. The subjects were categorized in to two groups. Group B patients received a bolus dose of 0.25% bupivacaine and group BD patients dexmedetomidine 1 µg/kg + 0.25% bupivacaine. Ultrasound- guided thoracic paravertebral block was carried out prior to general anaesthesia in all the subjects. Total morphine consumption was the primary outcome measured in the first post-operative 24 hours. The secondary outcomes assessed were visual analogue scale scores, peak expiratory flow rate, forced vital capacity and forced expiratory volume.

Results: The present study revealed no significant difference in demographic data between the groups. Group BD subjects showed low VAS scores at all the times ($P < 0.05$) and superior post-operative pulmonary functions.

Conclusion: The combination of paravertebral dexmedetomidine and bupivacaine in patients undergoing thoracic surgeries can provide a better analgesia, thus decreasing post-operative morphine requirements.

Keywords: Bupivacaine,Dexmedetomidine, Morphine, Paravertebral Blockade, Thoracic Surgeries.

INTRODUCTION

The paravertebral space is within the extrapleural space. Extending from thoracic levels 1 to 12, it is a wedge-shaped potential compartment bordering the vertebral bodies bilaterally. Paravertebral blockade (PVB) aims to result in ipsilateral somatosensory and sympathetic nerve block at multiple vertebral levels. Since its initial application for abdominal surgery, the technique has been adapted for rib fractures, flail chest, open cholecystectomy, hepatic-biliary surgery, outpatient inguinal hernia repair, major breast cancer surgery, and open thoracotomy patient populations.[1,2]

Thoracotomy pain occurs as a result of severe thoracic wall trauma, including rib fracture and peripheral nerve damage. Since acute postoperative pain is also a predictor of longterm pain after thoracotomy, early and aggressive treatment of pain may help to reduce the currently high frequency of chronic pain. It was observed that proper analgesia permits effective cough, leading to clear secretions and prevention of mucus plugs and atelectasis.[2]

Ultrasound guided technique in TPB is done as it allows enhanced paravertebral space localization with very few complications. TPB when compared to thoracic epidural block provides analgesia with additional haemodynamic stability owing to unilateral sympathetic block, Adjuvants used to enhance analgesia of paravertebral block are dexmedetomidine, magnesium, clonidine. and fentanyl.[3,4]

Dexmedetomidine is a new generation highly selective α2-adrenergic receptor (α2-AR) agonist that is associated with sedative and analgesic sparing effects, reduced delirium and agitation, perioperative sympatholysis, cardiovascular stabilizing effects, and preservation of respiratory function. Single and continuous PVB block techniques have been successfully administered for post-thoracotomy pain control. However, the duration of single-dose administered PVB block is limited to the effect of administered local anesthetics.

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A single shot technique using bupivacaine, levobupivacaine or ropivacaine can provide analgesia for up to 18 h. The addition of an adjuvant to local anesthesia may prolong block duration. Dexmedetomidine is a selective alpha-2 adrenergic agonist with both analgesic and sedative properties. When administered as a perineural adjuvant, dexmedetomidine reduces initial blocking time whilst prolonging sensory and motor blockade duration.[5-8]

We carried this study to find out whether addition of dexmedetomidine to continuous bupivacaine infusion via paravertebral catheter in thoracic surgeries improves the analgesic profile of paravertebral bupivacaine.

MATERIAL AND METHODS

50 ASA I-II patients aged 20-60 years were included in the study and scheduled for thoracic surgery, from January 1 2019 to December 31 2019, after obtaining institutional ethical committee clearance and informed consent from the subjects. Prior to anesthesia induction, the paravertebral blockade procedure was performed by an anesthetist with ultrasonography. Cases were randomly stratified into two groups, B and BD.

Exclusion Criteria

1. Patients with significant respiratory disorders, cardiac diseases, coagulation disorders,
2. Patients allergy to local anaesthetics or dexmedetomidine,
3. Patients with communication difficulties.

0.25% bupivacaine at 0.3 mL/kg was given to Group B subjects in the paravertebral space for 5 minutes, later 0.125% bupivacaine by catheter was given which was continued till 24 hours postoperatively. Group BD subjects were given Dexmedetomidine 1 μg/kg + 0.25% bupivacaine. Then dexmedetomidine 0.2 μg/kg/h and 0.125% bupivacaine 0.1 mL/kg/h was given.[6]

US guided TPVB was given prior to GA for all the subjects. GA propofol 2 mg/kg IV and fentanyl 2 μg/kg IV was administered. To facilitate tracheal intubation, Rocuronium 0.6 mg/kg IV was used.

Total morphine consumption was the primary outcome assessed and the secondary outcomes evaluated were VAS scores atdifferent time intervals both at rest and on coughing, fentanyl required, peak expiratory flow rate (PEFR), forced expiratory volume in the first second (FEV1), and forced vital capacity (FVC).

RESULTS

There was no significant differences found in terms of demographics [Table 1]. Descriptive data of study subjects is presented in Graph-1. Group BD subjects showed lower VAS scores, which was statically significant with cough after 30 minutes, 2, 12 and 24 post-operative hours ($P < 0.05$, Table 2). Group BD subjects revealed superior post-operative pulmonary functions (Table 3).

Six patients from group B suffered from postoperative nausea and vomiting (PONV), while only two patients in group BD had (PONV). In group BD, four subjects had hypotension and two had bradycardia. In group B, two had hypotension and one had bradycardia. There were no evidence of any other complications in study subjects related to the paravertebral

Variable	Group B (n=25)	Group BD (n=25)	P Value
Age in years: Mean ±SD	47.75± 16.30	48.92±16.12	0.732
Height in cm: Mean ±SD	162.40±40.28	164.96±48.75	0.986
Weight in Kg: Mean ±SD	70.23±5.52	69.38±5.58	0.658
Duration of Surgery in min. Mean ±SD	282.63±51.36	284.45±50.87	0.691
Gender: Male/Female Ratio	15/10	16/9	0.75

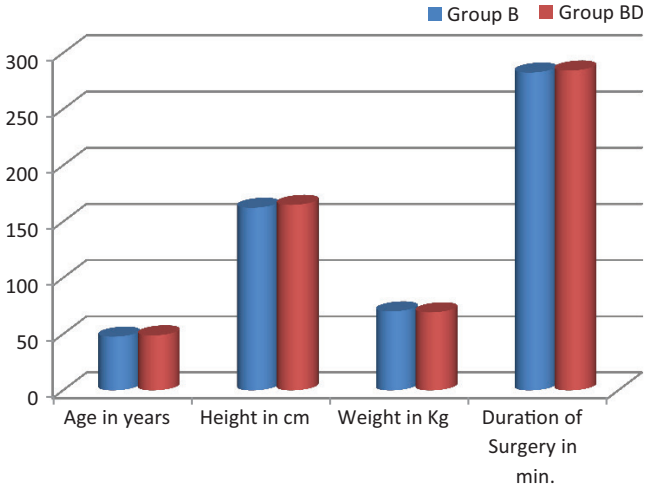
Table-1: Demographic Data of The Study Subjects

VAS score	Group B (n=25)			Group BD (n=25)			P value
	Median	Range	IQR	Median	Range	IQR	
VAS-R 30 min	2	1-3	1-2	2	0-3	1-2	1.0
VAS-R 2 h	2	1-3	1-2	2	1-3	1-2	1.0
VAS-R 4 h	2	1-3	1-2	2	1-3	1-2	1.0
VAS-R 6 h	1	1-2	1-2	1	0-2	1-2	1.0
VAS-R 12 h	1	0-2	1-1.5	1	0-2	1-1	1.0
VAS-R 24 h	1	0-2	0.5-1	1	0-2	0-1	1.0
VAS-C 30 min	3	1-6	2-4	1	1-4	1-2	0.036*
VAS-C 2 h	3	1-6	3-4	2	1-4	2-3	0.048*
VAS-C 4 h	3	2-4	2-3	2	1-3	2-3	0.336
VAS-C 6 h	3	1-4	2-3	2	1-3	1-2.5	0.12
VAS-C 12 h	3	2-4	2-3	2	1-3	1-2	0.001*
VAS-C 24 h	3	1-4	2-3	2	1-3	1-2	0.001*

Table-2: VAS scores in both the groups

Variable	Group B (n=25)	Group BD (n=25)	P value
% of predicted preoperative PEFR	80.4±15.42	77.32±14.24	0.64
% of predicted 24 h postoperative PEFR	42.89±14.27	63.82±14.98	<0.001*
% of predicted preoperative FVC	77.28±15.29	76.39±13.87	0.82
% of predicted 24 h postoperative FVC	43.12±13.67	61.28±15.38	<0.001*
% of predicted preoperative FEV1	76.38±15.23	77.26±14.02	0.74
% of predicted 24 h postoperative FEV1	44.29±13.92	63.92±16.98	<0.001*

Table-3: Pulmonary functions in both the Groups



Graph-1: Demographic data of the study subjects

technique.

DISCUSSION

The mechanism by which local anesthetic and dexmedetomidine produce analgesia are by sodium channel blockade and selective α-2 agonist actions respectively. Dexmedetomidine also has action at centre by α-2 adrenoreceptors of locus coeruleus, thus reducing subbstance P release and thereby inhibiting the nociceptive pathway. When compared with clonidine, dexmedetomidine has more specific α-2 agonist effect (8 times), hence has fewer undesirable actions that are α-1 receptors The α-2 agonist effect of.[3,9]

Previous studies showed that with multiple injections there was improved quality and also duration of analgesia, but was accompanied by many complications.[10,11] When fentanyl or clonidine was added to paravertebral bupivacaine, there was enhanced analgesia and reduced consumption of postoperative morphine in subjects undergoing breast surgeries. But there were increased incidences of post-operative complications like nausea, vomiting and hypotension.[10,11]

Mohta et al showed that a single paravertebral bolus of dexmedetomidine when added to bupivacaine provided an enhanced analgesia and decreased post-operative morphine consumption, which was also seen in our case.[3]

Hassan et al showed that addition of dexmedetomidine to local anaesthetic reduced the requirement of opioids in elective thoracotomy.[6] Our observation also supports this view.

Limitations

1. We could not evaluate the incidence of post-thoracotomy pain syndrome, as our post-operative assessment was only for 24 hours.
2. Lower sample size,
3. We did not assess the degree of post-operative sedation.

CONCLUSION

The combination of paravertebral dexmedetomidine and bupivacaine in patients undergoing thoracic surgeries can provide a better analgesia, thus decreasing post-operative morphine requirements.

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