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RESEARCH ARTICLE
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COMPARISION OF EFFICACY OF POST OPERATIVE ANALGESIA BY ULTRASOUND GUIDED BILATERAL ERECTOR SPINAE BLOCK USING 0.25 % LEVOPBUPIVACAINE WITH AND WITHOUT DEXMEDETOMIDINE IN ELECTIVE ADULT CARDIAC SURGERIES- RANDOMIZED DOUBLE BLINDED STUDY

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Abstract

Background: Post operative pain after cardiac surgeries is not only due to sternotomy but also because of tissue damage, drains, thoracic-cage retraction. ESP block helps for postoperative analgesia and enhanced recovery after cardiac surgery.[1]

Aim of the study: To compare the efficacy of dexmedetomidine as an adjuvant to levobupivacaine in single shot erector spinae block.

Materials and Methods: A Prospective randomized controlled study done in 50 patients who have undergone various cardiac surgeries. Study population randomized into 2 groups, 25 in each group. (Group I is LD & Group II LP) at our institute. Pre-operative variables like age, gender, EF, EUROSCORE II. Intra operative variables like heart rate, systolic, diastolic, mean arterial pressure, SPO_2, opioid requirement & muscle relaxant. Post operative variables like heart rate, systolic, diastolic, mean arterial pressure, SPO2, VAS, SS, inotropic score, opioid consumption, duration of mechanical ventilation, ICU stay, total chest drain, use of blood products, time for first rescue analgesia were compared between both groups.

Results: Total opioid requirement [p=0.212], time for 1st rescue analgesia [p=0.380] i.e. total duration of analgesia was similar in both groups & were statistically insignificant.

Conclusion: Dexmedetomidine when used as an adjuvant to 0.25% levobupivacaine for bilateral single shot ESP block didn't provide superior analgesia compared to without dexmedetomidine in adult elective cardiac surgical patients.

Keywords: Erector spinae block, elective cardiac surgeries, dexmedetomidine.

Introduction

Post operative pain in patients undergoing cardiac surgery is severe during the first 24 hours and it is not only due to sternotomy but also because of tissue damage, intercostal drain, thoracic-cage retraction. It has been shown that women after cardiac surgery report higher pain intensity than men and that elderly patients have a higher pain threshold.[2]

As concept of enhanced recovery after surgery has been practicing, regional anaesthesia has been considered as primary element of multimodal analgesia. However, traditional regional anaesthesia techniques such as thoracic epidural anaesthesia or paravertebral thoracic blocks are not routinely implemented in cardiac surgeries for postoperative pain protocols due to the concerns of perioperative heparinisation and the resulting risk of a spinal or epidural hematoma.[3]

The American Society of Regional Anesthesia (ASRA) 2018 guidelines suggest that performing deep peripheral nerve blockades (ie, a neuraxial or paravertebral block) in an anticoagulated patient is unsafe. Based on this principle, it has been suggested that for the ESP block, the risk of bleeding is low but it is outweighed by the benefit of superior analgesia.[4]

In Erector spinae plane (ESP) block administration of local anesthetic into the interfacial plane between the erector spinae muscles and the transverse processes of the thoracic vertebrae, hence the LA spreads both craniocaudally and anteriorly, via the foramina costotransverse. Thus, the ventral and dorsal rami of spinal nerves, dorsal root ganglion, and rami communicants can be blocked at multiple levels.[5]

Dexmedetomidine as an adjuvant can significantly prolong the effect of local anesthetics for nerve block, reduce postoperative pain, reduce the dosage of local anesthetics and opioids, and reduce adverse reactions.US-guided ESPB has been one of the most popular blocks especially for cardiac surgeries.[6]

AIM AND OBJECTIVE OF THE STUDY:

To compare the efficacy of dexmedetomidine when added to levobupivacaine as for post operative analgesia for cardiac surgery patients in terms of fast tracking, total analgesic requirement, possible complications due to block.

MATERIALS AND METHODS:

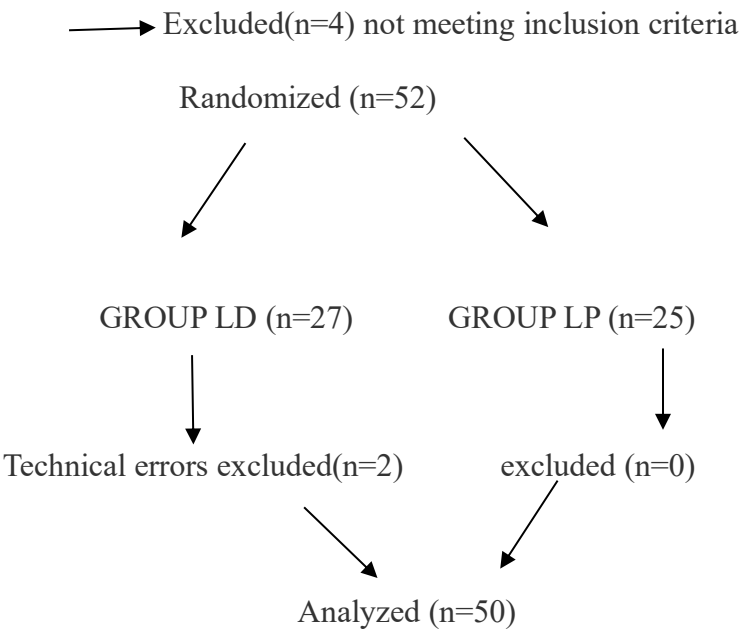
Study sample and randomization: The study was approved by the Institutional Ethics Committee (Ref.No.IEC/ NMC/ 05-01-2026_12). Written informed consent was obtained from all participants. All patients with an American society of anesthesiologists (ASA) physical status II-III, scheduled for elective cardiac surgeries were considered in a period of 4 months December 2022 and March 2023.

Inclusion criteria:

Patients undergoing elective cardiac surgeries requiring general anaesthesia.
Age >18 years, EF >40%.

Exclusion criteria:

Refusal of patient, age < 18 years, inflammatory or infection at injection site, allergy to local anaesthetics, altered coagulation profile, spine deformities.



All the patients were randomly divided into two groups using a computer-generated random-cards list and a 1:1 allocation ratio. Group LP received 60 mL of 0.25% levobupivacaine. Group LD received 0.25% levobupivacaine plus 20 µg of dexmedetomidine, solution prepared by anaesthesia post graduate who has not involved in this study. All the other investigators and all the patients were blinded to the group allocation throughout the entire perioperative period. The patients were also taught about the VAS score prior surgery.

Procedure:

Following routine fasting guidelines & consent, patients were shifted to operating room connected to standard ASA monitors, arterial cannulation done for invasive blood pressure monitoring prior induction. All subjects received bolus dose of 1mcg/kg dexmedetomidine infusion which was continued perioperatively in a dose of 0.5 µg/kg till 12 hours after completion of surgery. Patients induced by using standard institutional protocols using inj. midazolam 0.25mg/kg, inj. fentanil 2-2.5 µg/kg, inj. etomidate 0.3 – 0.4mg/kg and inj. vecuronium 0.5mg/kg, airway secured with standard size of ET tube using direct laryngoscopy. Intermittent positive pressure ventilation initiated using closed breathing circuit with appropriate ventilator settings. Maintenance of anaesthesia done with sevoflurane 1-2%, intermittent opioid & muscle relaxants. and continuous infusion of dexmedetomidine 0.5 µg/kg/min to maintain the BIS value between 40 and 60.

Ultrasound-guided erector spinae plane block

Following induction, the patients kept in left lateral position. Under strict aseptic precautions using high-frequency linear ultrasound probe, an in-plane technique was then used after imaging the trapezius, rhomboid major, erector spinae, and T5 transverse processes. 22-G, 80-mm needle was inserted in a caudo-cephalad orientation. After confirmation of needle position by means of hydro dissection using alliquots of 2 mL 0.9% normal saline that separated the transverse process from the erector spinae muscle. 60 ml of total volume of drug [0.25% levobupivacaine + 20 mcg dexmedetomidine] injected at both levels T5 & T7 bilaterally (30 ml each). All the blocks were performed by a senior anaesthesiologist with extensive experience in ultrasound-guided nerve blocks. Local infiltration at drain sites at the commencement of surgery was given for all patients. Intravenous fentanyl used as primary rescue analgesic in the present study.

Statistical analysis: Statistical analysis was done using statistical package for the social sciences (SPSS)1.5 software. Data were expressed as mean standard deviation or numbers and percentages. p value <0.05 was considered as statistically significant. Descriptive statistics were presented by Mean, Standard Deviation. For the comparison of two groups, and to determine the significance, student unpaired t-test was used with p value <0.05. Other data were displayed by various tables and charts by using Microsoft office excel (Windows 2007).

Results:

Table 1: Comparison of demographic data

variable	Group LD	Group LP	p value
Age	51.12 ±9.97	51.52 ± 13.50	0.905
Height	164.56 ± 0.15	165.08± 6.72	0.792
Weight	63.96 ± 5.36	62.76 ±7.70	0.525
BSA	1.77± 0.06	1.75 ± 0.08	0.359

Table 2: gender distribution between two groups

Gender	Group LD	Group LP	p value
Male	15	17	0.555
female	10	8	

Table 3: Comparison of pre-operative variables

variable	Group LD	Group LP	p vlaue
Euroscore II	3.24 ± 0.52	3.44 ± 0.68	0.207
Pre op LVEF	51.60 ± 4.25	51.60 ± 4.51	0.676

Table 4: Comparison of diagnosis & surgeries in both groups

Diagnosis and surgeries	Group LD	Group LP
CABG	15	13
CABG-AVR	1	0
AVR	2	2
MVR	5	5
CABG+ MV REPAIR	1	1
VSD / ASD	1	1
RA MYXOMA	0	1

Table 5: Comparison of Pre - operative vitals

variable	Group LD	Group LP	p value
HR	82.24 ± 10.44	88.36 ± 13.47	0.078
SBP	135.28 ± 10.91	134.88 ± 21.22	0.933
DBP	84.32 ± 8.92	86.72 ± 10.08	0.377
MAP	101.29 ± 8.11	103.76± 12.51	0.625
SPO2	99.64 ± 0.57	99.72 ± 0.54	0.612

Table 6. Comparison of vitals at 5 min after block

Variable	Group LD	Group LP	p value
HR	77.00 ± 13.14	73.64± 12.02	0.350
SBP	122.84 ± 13.92	117.24 ± 15.65	0.187
DBP	76.64 ± 8.10	73.60 ± 8.80	0.209

MAP	92.26 8.47	90.64 6.77	0.4524
SPO2	99.80± 0.42	99.96 ± 0.20	0.084
OPIOD	8.00 ± 17.26	9.00 ± 17.50	0.839
M.RELAXANT	Nil	nil	-

Table 7:Comparison of vitals at 15 min after block

Variable	Group LD	Group LP	p value
HR	6.33 ± 21.69	68.52 ± 7.73	0.490
SBP	117.92 ± 15.30	120.28 ± 13.54	0.566
DBP	68.15 ± 5.90	69.64 ± 7.06	0.411
MAP	89.16 6.97	89.48 6.15	0.8641
SPO2	99.76 ± 0.44	99.44 ± 0.37	0.489
OPIOD	10.80 ± 13.90	11.40 ± 13.75	0.878
M.RELAXANT	0.92 ± 0.70	1.04 ± 0.79	0.578

Table 8: Comparison of vitals at 30 min after block

Variable	Group LD	Group LP	p value
HR	68.68 ± 5.79	68.32 ± 6.54	0.837
SBP	115.64 ± 14.91	111.20 ± 13.46	0.274
DBP	67.00 ± 6.81	66.12 ± 6.77	0.648
MAP	76.72 9.89	79.32 8.56	0.3254
SPO2	99.76 ± 0.44	99.60 ± 0.50	0.233
OPIOD	4.00 ± 9.35	4.80 ± 9.41	0.764
M.RELAXANT	1.31± 4.60	0.64± 0.64	0.473

Table 9: Comparison of vitals at 60 min after block

Variable	Group LD	Group LP	p value
HR	73.88 ± 6.78	73.44 ± 7.27	0.825
SBP	115.84 ± 11.82	112.16 ± 12.68	0.293
DBP	64.40 ± 8.35	64.96 ± 8.35	0.211
MAP	82.16 9.25	82.72 10.04	0.838
SPO2	99.84 ± 0.37	99.60 ± 0.65	0.114
OPIOD	6.60 ±10.97	5.00 ± 10.21	0.595
M.RELAXANT	0.67 ± 0.58	0.76 ± 0.52	0.568

Table 10: Comparison of vitals at 2hour after block

Variable	Group LD	Group LP	p value
HR	83.44 ± 8.34	79.48 ± 10.96	0.156
SBP	106.32 ± 16.07	103.92 ± 15.76	0.596
DBP	61.92 ± 8.04	61.76 ±7.86	0.943
MAP	76.72 ± 9.89	77.76 ± 9.70	0.7090
SPO2	99.60 ± 0.58	99.80 ± 0.41	0.163
OPIOD	3.60 ± 4.90	4.80 ± 5.10	0.40
M.RELAXANT	0.68 ± 0.56	0.56 ± 0.51	0.429

Table 11:Comparison of vitals at 3hours after block

Variable	Group LD	Group LP	p value
HR	82.76 ± 8.67	85.12 ± 8.55	0.337

SBP	116.76 ± 13.77	111.96 ± 11.15	0.1819
DBP	70.96 ± 10.22	68.68 ±10.13	0.4322
MAP	86.24 ± 10.51	85.72 ± 9.76	0.8569
SPO2	99.76 ± 0.44	99.72 ± 0.46	0.7532
OPIOD	3.20 ± 5.57	7.80 ± 12.00	0.0884
M.RELAXANT	0.72 ± 0.79	0.52 ± 0.59	0.3150

Table 12:Comparison of vitals at 4 hour after block

Variable	Group LD	Group LP	p value
HR	85.96 ± 14.51	80.28 ± 11.58	0.1327
SBP	125.52 ± 21.31	122.60 ±20.59	0.6245
DBP	69.96 ± 11.72	68.32 ± 12.43	0.6334
MAP	82.16 ± 9.25	86.36 ± 13.75	0.2113
SPO2	99.36 ± 0.86	99.12 ± 0.93	0.3475
OPIOD	6.60 ± 8.75	3.00 ± 6.12	0.0983
M.RELAXANT	0.72 ± 0.84	0.64 ± 0.70	0.7166

POST OPERATIVE VARIABLES:

Table 13: Comparison of parameters during Immediate post operative period

VARIABLE	GROUP LD	GROUP LP	p VALUE
HR	97.56 ± 18.16	89.28 ±10.71	0.055
SBP	127.20 ±24.33	132.60 ± 23.05	0.424
DBP	72.80 ± 16.33	80.40 ± 15.86	0.101
MAP	90.96 ±17.82	97.48 ± 17.35	0.1962
SPO2	99.60 ± 0.50	99.52 ± 0.51	0.578
VAS	0	0	0
SS	5.80 ± 0.41	5.60 ± 0.50	0.127
OPIOID	NIL	NIL	NIL
INOTROPE	6.48 ± 2.35	6.52 ± 2.33	0.952

Table 14: Comparison of parameters at 2hrs

VARIABLE	GROUP LD	GROUP LP	p VALUE
HR	86.16 ± 14.83	83.68 ± 11.83	0.516
SBP	119.52 ± 16.21	123.68 ± 17.18	0.382
DBP	70.96 ± 10.83	75.88 ± 10.02	0.102
MAP	91.68 ± 10.25	92.44 ± 9.77	0.789
SPO2	99.68 ± 0.48	99.60 ± 0.50	0.565
VAS	0.20 ± 0.41	0.80 ± 0.41	0.011
SS	3.48 ± 0.51	2.48 ± 0.51	0.001
OPIOID	NIL	NIL	NIL
INOTROPE	7.84 ± 3.13	7.48 ±3.27	0.692

Table 15: Comparison of parameters at 4 hours

VARIABLE	GROUP LD	GROUP LP	p VALUE
HR	96.48 ± 11.36	97.28 ± 12.45	0.813
SBP	125.00 ± 21.41	127.68 ± 18.02	0.632
DBP	69.68 ± 11.42	72.56 ± 8.68	0.320
MAP	88.08 ± 11.56	90.92 ± 8.76	0.332

SPO2	99.80 ± 0.41	99.24 ± 1.16	0.027
VAS	0.56 ± 0.51	0.80 ± 0.41	0.071
SS	1.90 ± 0.71	2.48 ± 0.51	0.011
OPIOID	0.00	1.40 ± 5.31	0.193
INOTROPE	8.44 ± 4.17	8.64 ± 3.95	0.862

Table 16: Comparison of parameters at 6 hours

VARIABLE	GROUP LD	GROUP LP	p VALUE
HR	81.28 ± 12.64	83.44 ± 11.87	0.536
SBP	122.92 ± 20.61	125.52 ± 21.37	0.662
DBP	64.96 ± 8.94	66.56 ± 9.19	0.535
MAP	84.40 ± 8.67	86.76 ± 7.38	0.305
SPO2	99.44 ± 0.65	99.48 ± 0.59	0.820
VAS	1.28 ± 0.46	1.48 ± 0.51	0.152
SS	2.44 ± 0.51	2.52 ± 0.51	0.580
OPIOID	2.60 ± 7.38	3.48 ± 8.28	0.687
INOTROPE	8.76 ± 4.05	8.68 ± 4.21	0.945

Table 17 : Comparison of parameters at 8 hours

VARIABLE	GROUP LD	GROUP LP	p VALUE
HR	98.48 ± 12.10	98.60 ± 12.12	0.972
SBP	122.40 ± 15.42	123.20 ± 15.13	0.853
DBP	69.32 ± 10.46	71.92 ± 11.30	0.402
MAP	86.72 ± 8.99	87.64 ± 8.72	0.715
SPO2	97.96 ± 1.02	98.12 ± 1.01	0.580
VAS	5.52 ± 0.71	5.40 ± 0.71	0.553
SS	1.16 ± 0.37	1.32 ± 0.48	0.192
OPIOID	NIL	NIL	NIL
INOTROPE	8.20 ± 4.07	7.72 ± 4.26	0.685

Table 18 : Comparison of parameters at 12 hours

VARIABLE	GROUP LD	GROUP LP	p VALUE
HR	87.64 ± 10.94	89.52± 10.97	0.546
SBP	118.44 ± 13.24	119.72 ± 13.91	0.740
DBP	71.36 ± 10.01	69.60 ± 10.96	0.556
MAP	87.08 9.51	86.32 9.71	0.781
SPO2	98.68 ± 0.99	98.16 ± 1.25	0.108
VAS	2.40 ± 0.50	2.68 ± 0.58	0.068
SS	1.76 ± 0.44	1.88 ± 0.33	0.278
OPIOID	NIL	NIL	NIL
INOTROPE	8.60 ± 4.09	8.44 ± 4.07	0.890

Table 19: Comparison of parameters at 24 hours:

VARIABLE	GROUP LD	GROUP LP	p VALUE
HR	98.48 ± 12.10	98.60 ± 12.12	0.972
SBP	122.40 ± 15.42	123.20±15.13	0.853
DBP	69.32 ± 10.46	71.92± 11.30	0.402
MAP	87.32 ± 11.20	88.56 ± 11.62	0.7025
SPO2	97.96 ± 1.02	98.12 ± 1.01	0.580

VAS	5.52 ± 0.71	5.40 ± 0.21	0.553
SS	1.16 ± 0.37	1.32 ± 0.48	0.192
OPIOID	NIL	NIL	NIL
INOTROPE	1.96 ± 2.35	2.80 ± 2.71	0.247

Table 20: Comparison of secondary outcomes between both groups

Parameter	Group LD	Group LP	p value
Hours of MV	4.52 ± 3.08	4.16 ± 2.82	0.192
Days of ICU stay	2.92 ± 1.28	2.40 ± 0.65	0.079
Total drain	823.8 ± 148.24	865.40 ±163.7	0.351
Blood products	1.04 ± 0.54	0.92 ± 0.64	0.476
Opioid	173.60 ± 39.15	188.00 ± 41.46	0.212
Time for 1st rescue analgesia	7.42 ± 2.04	6.92 ± 2.02	0.380

Table 20 and 21: Comparison of VAS scores for differential pain between both groups

VAS SCORES	Group LD [Incision]	Group LP [Incision]	p value
2nd hour	0	0	0
4th hour	0.55 ± 0.50	0.70 ± 0.51	0.070
6th hour	1.27 ± 0.45	1.45 ± 0.50	0.150
8th hour	3.52 ± 0.61	4.00 ± 0.61	0.453
12th hour	2.40 ± 0.40	2.86 ± 0.84	0.640
24 th hour	5.42 ± 0.69	5.30 ± 0.11	0.550

VAS SCORES	Group LD [drains]	Group LP [drain]	p value
2nd hour	1.38 ± 0.55	1.48 ± 0.87	0.168
4th hour	3.62± 0.81	4.02 ± 0.72	0.563
6th hour	5.46 ± 1.20	5.62 ± 1.00	0.668
8th hour	6.00 ± 1.40	5.58 ± 1.20	0.780
12th hour	6.48 ± 1.23	5.89 ± 1.40	0.792
24 th hour	5.06 ± 1.08	5.54 ± 0.17	0.680

Complications including post operative pneumothorax, nausea, vomiting, hypersensitive drug reaction were not seen among both the groups.

Discussion:

Krishna et al 2018[7] conducted prospective randomized controlled single blinded study on single shot ESP block at level of T6, in various types of adult cardiac surgeries in total 106 patients, where control group aren't received any block. Used 3ml/kg of 0.375% ropivacaine and concluded that bilateral ESP block provided better analgesia at rest compared to intravenous paracetamol and tramadol.

Macaire et al 2019 [8] conducted ESP block at T4 in 67 patients undergoing various cardiac surgeries (CABG, valve repair, Bentall etc) using 0.25% ropivacaine and concluded that total opioid consumption in 1st 48 hours was less compared to patients who didn't received block.

Boyer et al 2019 [9] conducted prospective observational study in 44 patients undergone MV/ TV repair at T4 with 0.2 ml/kg of 0.375% ropivacaine and observed better analgesia after right mini thoracotomy.

Vaughan et al 2021[10] conducted retrospective cohort study in 43 patients who undergone CABGs, aortic valve surgeries, ESP block given at T4-T5 level with 25 ml of 0.5% ropivacaine and continuous infusion with catheter with 3-7 ml/ hour till drains removed and concluded that decrease in length of the stay compared to patients with no block.

Ogur et al 2022 [11] conducted prospective randomized controlled study on patients undergone several types of adult cardiac surgeries, single shot ESP block at T4-T5 using 0.5ml/kg of 0.25% bupivacaine with 8mg dexamethasone and concluded that bilateral ESP block reduces total opioid requirement compared to patients who received only intravenous morphine.

From above studies, the inference obtained was that performing ESP block in patients who have undergone cardiac surgeries with different approaches using different type of local anesthetic agents with or without adjuvants gives better post operative analgesia and reduces overall requirement of opioids.

In present study, we have been performed single shot ESP block in total 50 patients who have undergone various types of cardiac surgeries using total volume of 60 ml [15 ml at each level bilaterally T5 and T7] with adjuvant dexmedetomidine in group LD and placebo in group LP, continuous infusion of dexmedetomidine 0.5 mcg/kg/hour maintained till 12 hours after surgery and local infiltration at drain sites at the end of surgery. Primary outcomes observed were perioperative haemodynamic changes, requirement of opioid and muscle relaxants and total duration of postoperative analgesia till 24 hours after surgery. Secondary outcomes in terms of duration of ICU stay and mechanical ventilation, inotrope requirements & blood products use were observed and compared between both groups.

Results were compared & analyzed and all above parameters were no statistical significance. Hence concluded that, adding adjuvant have no impact on perioperative hemodynamics, inotrope & blood product use, ICU stay or duration of mechanical ventilation. Hence adjuvant dexmedetomidine in ESP block might have no role in influencing above parameters. Duration of post operative analgesia was similar in both groups describing that ESP block with or without dexmetemodine might not have true significance as origin of post operative pain is not single. Most of the patients complained of differential pain, where most of them received first rescue analgesic for pain at chest drain rather sternotomy pain after wearing off local infiltration at drain site. Hence ESP block might not cover the dermatome involving chest drains but better analgesic method for pain due to median sternotomy.

Overall VAS scores were equal in both groups (median sternotomy VAS scores, p value = 0, 0.070, 0.150, 0.453, 0.640, 0.550), for drain site VAS scores (p value = 0.168, 0.563, 0.668, 0.780, 0.792, 0.680)due to differential site and sensitivity for origin and perception of pain which shows no adjuvant helps, rather needs for supplementing with other regional block or technique to tackle the drain site pain.

Conclusion:

Dexmedetomidine when used as an adjuvant to 0.25% levobupivacaine for bilateral single shot ESP block didn't provide superior analgesia compared to without dexmedetomidine in adult elective cardiac surgical patients.

Declarations:

Ethics approval and study consent: Institutional ethics committee of Narayana Medical College approval was obtained with committee Ref no. IEC/NMC/5thJanuary 2026/12

Consent for publication: N/A.

Availability of data and material: the datasets generated during and / or analysed during current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests'' in this section
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