

Efficacy of Bilateral Continuous Paravertebral Block for Off Pump Coronary Artery Bypass Surgery

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ABSTRACT

Aims and Objectives: The purpose of the study is to prospectively evaluate. 1.The feasibility and efficacy of bilateral continuous Paravertebral block for off pump coronary artery bypass surgery. 2.Time taken for extubation following cardiac surgery. 3.Hemodynamic parameters. **Methodology:** This was a prospective randomised study which included 60 patients, 30 each in Group A (PVB) and 30 patients in Group B (control). Group A had catheter inserted on either side of the spine in the paravertebral space at T3-T4 or T4-T5 level and a bolus of 0.25 mlkg⁻¹ Inj Bupivacaine 0.25% was given followed by an infusion of Inj Bupivacaine 0.125% at the rate of 0.15 mlkg⁻¹ hr⁻¹ throughout the surgery and continued postoperatively. In Group B Inj Fentanyl 1 µgkg⁻¹hr⁻¹ IV infusion was given intraoperatively and Inj Tramadol 1mg/kg TID IV post operatively. Parameters evaluated included hemodynamic parameters, visual analogue scale pain score (pain severity- 0-3=mild, 4-7=moderate, >7=severe) at rest and deep breathing, rescue analgesia at 0 hr, 4 hr, 8 hr, 12hr, 24hr and 36 hr, ICU and hospital stay. Unpaired t-test and chi-square test were used to compare values between 2 groups. **Results:** The severity of pain in group B was statistically significant at 0 and 8hr at rest and statistically significant at 0, 8, 12 and 24hr with deep breathing as compared with Group A. A less requirement of rescue analgesia was observed in Group A vs Group B (0.27+/- 0.72 vs 2.0+/-0.926). Group A had more stable haemodynamic parameters in post-operative period. Compared with the group B, the length of ICU and hospital stay in group A was numerically lower but not statistically significant (p=0.439 and p=0.560, respectively). **Conclusion:** Bilateral continuous Paravertebral block is feasible, provides good hemodynamic stability, excellent analgesia and allows early extubation.

Key words: Analgesia, Coronary artery bypass surgery, Paravertebral block, Visual analogue scale pain score, Hemodynamics, Extubation.

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INTRODUCTION

Maintaining hemodynamic stability in the perioperative period is the key factor in the management of off pump coronary artery bypass surgery (OPCAB). Pain causes sympatho-adrenal stimulation leading to alteration in hemodynamic parameters resulting in imbalance between myocardial oxygen demand and supply, which can precipitate perioperative myocardial ischemia¹⁻² Pain also hinders respiratory efforts leading to pulmonary complications and hypoxemia in the post operative period.

Various regional techniques have been in use in conjunction with general anaesthesia to alleviate pain. Unilateral paravertebral block has been used in MIDCAB (Minimally Invasive Direct Coronary artery Bypass surgery)² and robotic assisted coronary artery bypass surgery.³ Bilateral paravertebral block has been successfully used in abdominal vascular surgery,⁴ bilateral thoracotomy⁵ and also for obstetric analgesia.⁶

In this study we attempted to evaluate the feasibility and efficacy of bilateral continuous paravertebral block in conjunction with general anaesthesia for OPCAB.

MATERIALS AND METHODS

After obtaining institutional ethical committee approval and written informed consent, a prospective randomised clinical study was conducted at Sri Jayadeva Institute of Cardiovascular Sciences and Research.

60 patients of either sex scheduled for elective OPCAB were studied. Patients were randomised into Group A (n=30) who received PVB or Group B (n=30) who received Inj Fentanyl IV infusion. Inclusion criteria were, patients who have been diagnosed with coronary artery disease (single, double or triple disease) requiring isolated CABG with median

sternotomy, able to give their informed written consent and > 21 years of age.

Patients with infection at the site of PVB, failed PVB, anomaly of vertebral column, Left Main Coronary artery lesions, EF <40%, associated valvular heart disease or pre-existing neurological, respiratory, renal or liver diseases were excluded from the study.

All patients were pre-medicated with Inj. Midazolam 0.01mg/kg I.V before surgery. On arrival of patient in the operation theatre, ECG, pulse oximetry was applied and arterial cannulation was performed under LA.

Bilateral PVB was performed in the patient placed in sitting position. The puncture site was 2.5 cm lateral to the spinous process of the T3 or T4 vertebrae. A one and half inch hypodermic needle was used for local infiltration of Inj Xylocaine 2% and also to identify the transverse spinous process. A 16G Touhy needle was passed between the transverse process of T3 and T4 or T4 and T5 and the paravertebral space was identified by loss of resistance technique with a saline filled syringe. An 18G catheter was passed through the needle and approximately 3 cm of the catheter was left in the space. The procedure was performed on either side of the spine. After securing the catheters patient was placed in supine position. A bolus dose of 0.25ml/kg of Inj Bupivacaine 0.25% was injected through both the catheters after negative aspiration for blood and CSF and followed by an infusion of Inj Bupivacaine 0.125% at the rate of 0.15ml/kg/hr in both the catheters.

Anaesthesia was induced in all patients with Inj. Fentanyl 5µg/kg IV, Inj. Midazolam 0.05mg/kg IV, Inj. Vecuronium 0.1mg/kg IV and Inj. Propofol 0.5-1mg/kg IV. Anaesthesia was maintained with Isoflurane in oxygen-air mixture and muscle relaxation with vecuronium 1 µg/kg/hr in both the groups. An infusion of Inj Fentanyl 1µg/kg/hr was started in Group B patients. Surgical team was same for all the cases. Monitoring

included lead ECG with ST-T analysis, invasive arterial blood pressure monitoring, temperature, pulse oximetry, ETCO₂, urine output, Activated Clotting Time and ABG analysis. Hemodynamic parameters recorded were heart rate, mean arterial pressure and central venous pressure.

After the surgery, patients were transferred to post-surgical ICU and extubated when deemed fit. Quality of analgesia was assessed by an anaesthesiologist who was not involved in the clinical care of the patient. Visual Analogue Scale (VAS) at 0hr, 4hr, 8hr, 12hr, 24 hr and 36 hr at rest and deep breathing were recorded. (0-3=mild pain, 4-7=moderate pain; >7 severe pain). Inj. Bupivacaine 0.125% at the rate of 0.15ml/kg/hr was continued post-operatively in Group A patients. Group B patients received analgesia in the form of Inj. Tramadol 1mg/kg IV TID. Patients with a VAS score of >4 or on patient demand, rescue analgesia as Inj. Diclofenac 75mg I.M was administered in both groups. The number of rescue analgesia required, total time to extubation, length of ICU stay and hospital stay were recorded. Any complications were also noted. The data was analysed using SPSS v 21 software. All the data were presented as Mean +/- S.D. Unpaired *t*-test was used to analyse the data of the mean value of the 2 groups. Chi-square test was used to analyse the categorical data. *p* value <0.05 is considered as statistically significant.

RESULTS

The demographic data in both groups were comparable (Table 1). The number of grafts and ejection fraction were also comparable in both the groups.

The intraoperative hemodynamic data recorded at various intervals was also comparable in both the groups.

The average fentanyl dose required in Group A was 403.33± 83.38 µg and in Group B was 600 ± 93.47 µg which was statistically significant with *p* value of 0.044.

The average extubation time in Group A was 266.67± 79.34 min and in Group B was 383.33 ± 74.03 min which was not statistically significant. (Graph 1).

There was a statistically significant increase in the heart rate post operatively in Group B, while the Mean Arterial Pressure was comparable between the two groups. (Graph 2).

The severity of pain at rest in group B was statistically significant at 0 and 8hr (Graph 3A). The severity of pain was statistically significant at 0, 8,

12 and 24hr with deep breathing in group B as shown in (Graph 3B) and pain score at various time interval at rest and deep breathing is shown in (Graph 4).

The number of rescue analgesia given were significantly more between 0 to 24 hr in Group B (2 ± 0.926) as compared to Group A (0.27 ± 0.702). (Graph 5).

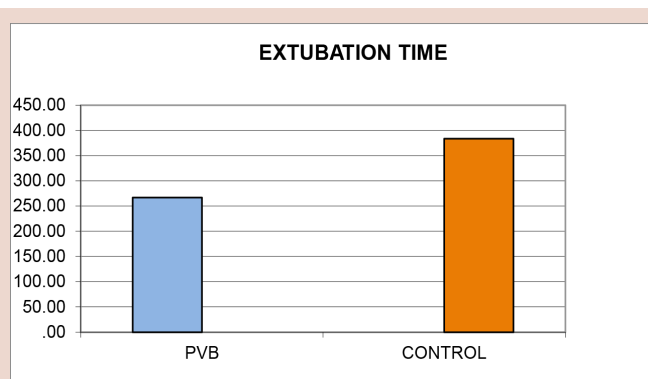
Three patients in group B had postoperative vomiting but none in group A and this was statistically insignificant.

The length of ICU stay was lower in Group A (2.40 ± 0.51 days) as compared to Group B (3.13 ± 0.83 days) as shown in Graph 6, but, was statistically insignificant (*p* value 0.439). The length of hospital stay was comparable between the groups 8.27 ± 1.23 days and 9.27 ± 1.90 days respectively (*p* value 0.560) as shown in Graph 6.

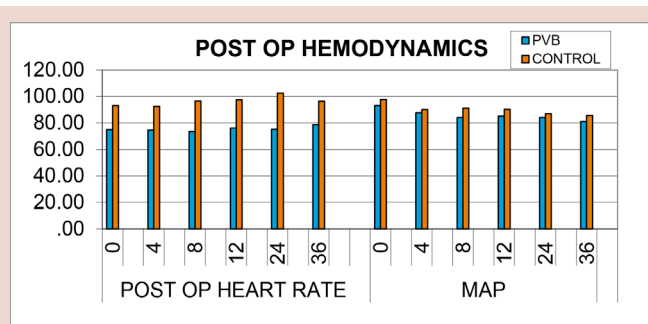
DISCUSSION

Postoperative pain after cardiac surgery remains a challenge that may be associated with increased morbidity and mortality. Previous studies have shown that ineffective pain management may lead to serious pulmonary complications because of insufficient clearance of secretions, mucous plugging and atelectasis.⁷⁻⁹

Various treatment modalities have been introduced for the postoperative pain management in cardiac surgery. PVB is a well-accepted technique for post thoracotomy pain relief. It is a safer and easier technique to perform.¹⁰ PVB affects intercostal nerves, ipsilateral sympathetic chain and posterior rami.³ Continuous infusion of a local anaesthetic provides



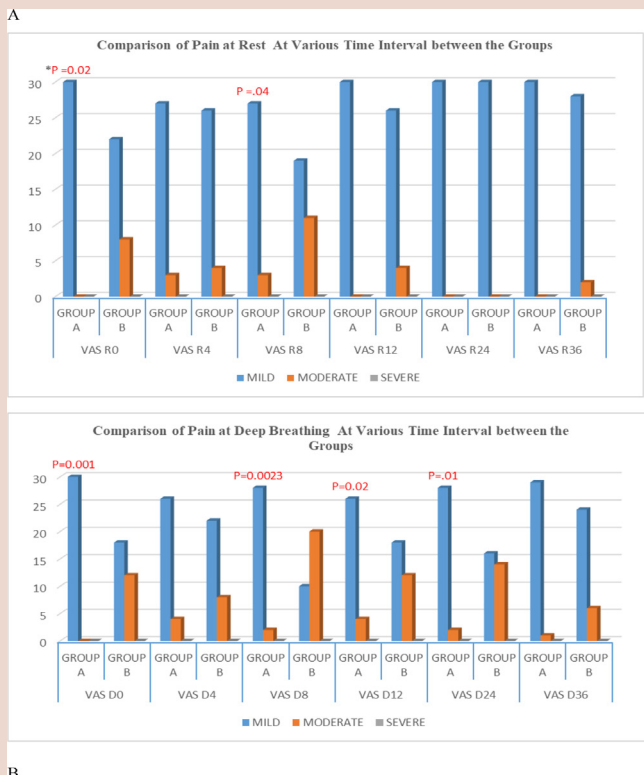
Graph 1: Average Extubation time in Group A (PVB) was 266.67±/− 79.34 min Vs Group B (Control) was 383.33±/− 74.03 min.



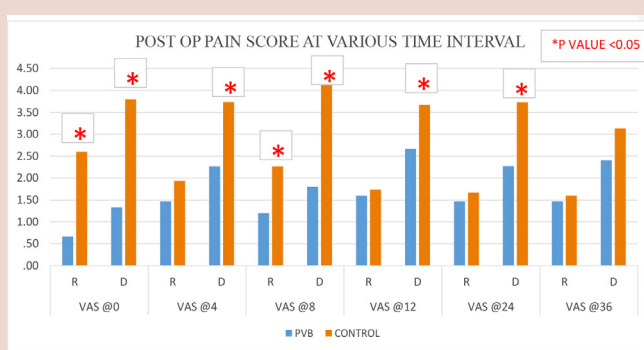
Graph 2: Changes in Heart Rate and MAP was comparable in both the groups.

Table 1: Demographic Data which was comparable between 2 groups.

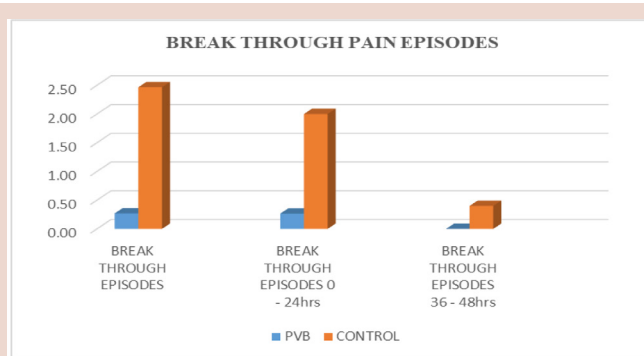
	PVB	CONTROL	P VALUE
Age	49.73	52.8	0.12
Weight	62.07	67.07	0.343
Height	162.4	162.87	0.190
Gender	22	19	0.29
	8	11	
Ejection Fraction (%)	54.25±/−7.025	51.01±/−6.25	0.747
Preoperative Medications			
• ACEI			
• Beta Blockers ,	8	9	
• Calcium Channel Blockers	4	5	0.812
	7	8	
• ACEI +CCB	11	8	
Number Of Grafts	3.05±/−0.604	2.8±/−0.52	0.170
Duration Of Surgery	286±/−37.57	265±/−32.43	0.415
Inotrope Score (24hrs)	4.85±/−1.81	4.25±/−1.37	0.097



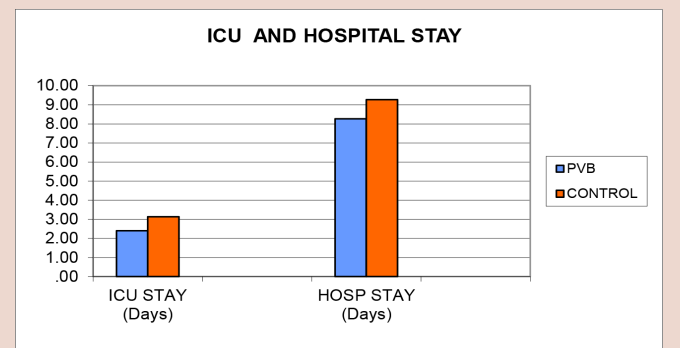
Graph 3: Comparison of Pain at Rest (A) And Deep Breathing (B) At Various Time Interval between the Groups.



Graph 4: Comparison of Pain Score at Rest (R) and Deep Breathing (D) At Various Time Interval between the Groups.



Graph 5: Break through episodes and rescue analgesia between Group A (PVB) vs Group B (Control).



Graph 6: Length of ICU and Hospital stay between 2 groups.

effective analgesia, maintains hemodynamic stability, restores respiratory mechanics and prevents pulmonary complications.¹¹

Dhole *et al* has found PVB to be as effective as thoracic epidural analgesia (TEA) after minimally invasive direct coronary artery bypass grafting surgery (MIDCAB).¹ Hypotension and urinary retention occurred less frequently in the PVB group, as compared to continuous TEA which may be an additional advantage of this technique over TEA.¹ Yatin Mehta *et al* have compared PVB to TEA in robotic assisted coronary artery bypass surgery and found no difference in intraoperative hemodynamic parameters in both the groups.³ The potential risk of an epidural hematoma after puncture of epidural vessels and subsequent anticoagulation is a major concern with regard to the TEA technique which is not seen with PVB.

Canto and colleagues, in 2003, studied continuous bilateral PVB for conventional cardiac surgery. They found lower pain scores during the ICU stay, with good hemodynamic stability and a lower rate of pulmonary complication.¹²

The severity of pain (0 hr and 8 hr at rest and 0,8,12 and 24 hr with deep breathing) in Group A was lesser compared to Group B after extubation, which was statistically significant. The number of rescue analgesia was also less in PVB group. The results of the present study suggest that analgesic effects of paravertebral block were better than intravenously administered opioids. PVB also offers significant advantage in terms of post-operative pain relief, reduced opioid consumption, reduced incidence of postoperative nausea and vomiting (PONV), decreased ICU stay and better patient satisfaction.¹³⁻¹⁴

PVB in conjunction with general anaesthesia, Wetz *et al.*¹³ and Coveney *et al.*¹⁴ both demonstrated significant cost saving (up to 22%). The lower cost was attributed to reduced need for post operative monitoring and nursing staff.

In the present study the length of ICU stay was lower in Group A (2.4 ± 0.51) as compared to Group B (3.13 ± 0.83) but statistically insignificant. Although rare, complications can occur with PVB. The most notable include pleural puncture and epidural spread of local anaesthetic agents. In our study no such complications were observed. Relative small sample size is one of the limitation of the study.

CONCLUSION

Bilateral PVB can be a feasible, safe and effective technique for perioperative analgesia in patients undergoing OPCAB surgery.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUMMARY

Bilateral parvertebral block is a feasible technique for perioperative analgesia in patients undergoing OPCAB surgery. Bilateral PVB provides superior analgesia with hemodynamic stability and decreases the use of intravenous opioids allowing early extubation and shorter ICU stay.

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Thankful to all the patients who have consented for the study

ABBREVIATIONS

OPCAB: Off Pump Coronary Artery Bypass Surgery; **MIDCAB:** Minimally Invasive Direct Coronary Artery Bypass Surgery; **PVB:** PARAVERTEBRAL BLOCK; **CSF:** Cerebrospinal Fluid; **VAS:** Visual Analogue Scale; **TEA:** Thoracic Epidural Analgesia; **PONV:** Post-operative Nausea And Vomiting

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