Efficacy of Erector Spinae Plane Block for Postoperative Pain Management in Adult Cardiac Surgery Among CABG Patients.

Original Article

Santosh S. Parajuli and Diwas Manandhar

Department of Cardiac Anaesthesia, Shahid Gangalal National Heart Centre, Bansbari, Kathmandu, Nepal

ABSTRACT

Background: Perioperative pain management plays a key role in the management of patients undergoing cardiac surgery. We studied the effect of erector spinae plane block on acute intraoperative and postoperative pain and 24 h opioid consumption in adult cardiac surgical patients

Methods: Over six months, 50 consecutive adult cardiac surgical patients scheduled for cardiac surgery were enrolled in the study. A bilateral erector spinae plane catheter was placed in one group and local anesthetics were infused whereas in the other group opioids were used for pain management. The primary study endpoint was to compare the consumption of fentanyl and to assess the numeric rating scale in the postoperative period in the first 24 h in both groups.

Results: The 24 h fentanyl consumption was 43.00 ± 51.29 micrograms in erector spinae plane catheter group and 147.00 ± 60.94 micrograms in the control group in the first 24 h postoperatively, which was statistically significant ($P < 0.001$). The numeric rating scale was also significantly less in the ESP group compared with the control group in the first 24 h postoperatively.

Conclusion: Erector spinae plane block is superior to the conventional opioid injection method for postoperative pain management in adult cardiac surgical patients. ESP block not only decreases the overall opioid consumption but also the NRS score in these patients.

Key Words: Erector spinae plane, numeric rating scale, pain.

Received: 28 May 2023**, Accepted:** 24 September 2023

Corresponding Author: Santosh Sharma Parajuli, MD, Shahid Gangalal National Heart Centre, Bansbari, Kathmandu, Nepal **Tel.:** +977-9806532132, **Fax:** +977-1-4371123, **E-mail:** santoshparajuli77@hotmail.com

ISSN: 2090-925X, The Egyptian Journal of Cardiothoracic Anesthesia 2024, 18: 5-7

BACKGROUND

Perioperative pain management plays a key role in the management of patients undergoing cardiac surgery. Postoperative surgical pain due to sternotomy and sternal retraction is severe[1]. Ineffective pain management results in systemic complications, for example, pulmonary atelectasis, pneumonia, increased oxygen consumption and tachycardia, resulting in prolonged ICU stay as well as increased cost[2].

Numerous modalities of pain management techniques have been used for cardiac surgery like thoracic epidural anesthesia (TEA), paravertebral block (PVB) and erector spinae plane (ESP) block as well as perioperative opioids. Cardiac surgery is often performed in patients receiving anticoagulant therapy. The chances of epidural hematoma and hypotension are high in patients who receive thoracic epidural anesthesia[3]. PVB, however, has a high risk of puncturing the pleura resulting in pneumothorax[4]. The use of perioperative opioids produces side effects such as nausea/vomiting, respiratory depression, postoperative chronic opioid use and increased risk of chronic pain[5].

Ultrasound-guided (ESP) block technique can be performed safely in anticoagulated patients, as the fascial plane has less number of vessels and it avoids epidural vessels.

This technique aims to evaluate whether this technique improves acute postoperative pain and reduces overall 24 h opioid consumption.

METHODS

This was a prospective observational study performed at Shahid Gangalal National Heart Center of Nepal. After obtaining Institutional Review Board approval, 25 adult cardiac surgical patients who underwent cardiac surgery with sternotomy and who had placed ESP catheter preoperatively were placed in group E and 25 adult cardiac surgical patients who underwent cardiac surgery with sternotomy and for whom pain management was done by conventional opioid injection method were kept in group C. The sample size was calculated from a previous similar study by Macaire *P et al.*[1] It was calculated that

DOI: 10.21608/EJCA.2024.372588

23.7 patients would be required to have 95 % confidence interval and a power of 90 %. So our sample size was 25 patients in each group, i.e a total of 50 patients. Patients who had inserted ESP catheter received local anesthetic bupivacaine 0.2 % 20 ml on each side through a catheter. The patient continued to receive the local anesthetic bupivacaine 0.1 % 10 ml on each side postoperatively every 4 hours. Both of the groups received intravenous paracetamol 1 gram 6 hourly. Postoperatively, patients having a numeric rating pain score (NRS) of > 4 were given a rescue analgesic (Fentanyl 0.5 mcg/kg) in both the groups. The cumulative dose of opioid consumed in the 24 h post-extubation was recorded from the ICU chart. Numeric rating pain scale (NRS) at times 0, 4, 8, 12, 16, 20 and 24 h post-extubation in both the groups were also recorded from the ICU chart.

Collected data were analyzed using the statistical software SPSS22. Statistical analysis for demographic variables was done by the chi-square test and Student's paired t-test was applied to compare the mean 24 h opioid consumption and NRS score at 0, 4, 8, 12, 16, 20 and 24 h post-extubation in both groups. A *P* value of < 0.05 was considered to be statistically significant.

RESULTS

The demographic data of the two groups are comparable as shown in Table 1. The 24 h fentanyl consumption was 43.00 ± 51.29 micrograms in the erector spinae plane catheter group and 147.00 ± 60.94 micrograms in the control group in the first 24 h postoperatively, which was statistically significant (*P* < 0.001) as shown in Table 2. The numeric rating scale was also significantly less in the ESP group compared with the control group in the first 24 h postoperatively as shown in Table 3 and Figure. 1.

Table 1: Demographic data of the patients:

Variables	Group E	Group C
Age in years median (range)	62 (40 – 77)	55 (31 – 75)
Gender male: female	18:7	16:9
Weight in kg median (range)	59 (44 – 88)	63 (43 – 84)
Height in cm median (range)	158 (140 – 176)	162 (45 – 84)
BMI in kg/m2 median (range)	24.5 (18.9 – 29.29)	25.51 (18.02 – 29.63)

Table 2: Comparison of total Fentanyl consumption:

	Group E (mean ± SD)	Group C (mean ± SD)	*P* value
Fentanyl (mcg)	43.00 ± 51.29	147.00 ± 60.94	< 0.001

Table 3: Comparison of NRS score:

Time (hours post-extubation)	Group E (mean±SD)	Group C (mean±SD)	*P* value
0	2.36 ± 1.221	3.36 ± 1.186	0.005
4	2.40 ± 1.000	2.96 ± 0.935	0.046
8	2.16 ± 1.143	3.68 ± 1.030	< 0.001
12	2.32 ± 1.030	3.00 ± 1.291	0.045
16	1.92 ± 1.187	3.04 ± 0.790	< 0.001
20	2.24 ± 0.831	3.04 ± 0.935	0.002
24	1.72 ± .0843	2.64 ± 1.150	0.002

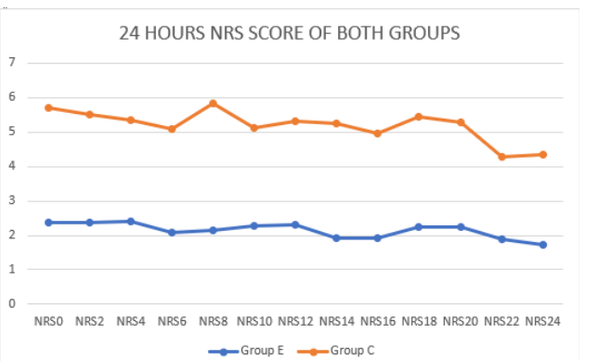

Figure 1: Comparison of 24 h NRS score in both groups.

DISCUSSION

Ineffective postoperative pain management in cardiac surgery results in several complications leading to prolonged hospital stay as well as increased cost. Therefore, adequate pain management is essential in reducing the adventitious circumstances. The result of this study has demonstrated that the use of ESP block has significantly reduced the consumption of opioids in the ESP group in comparison to the control group in the first 24 h postoperatively. Furthermore, the ESP block also showed that the numeric rating scale (NRS) is lowered in the ESP group than in the control group in the postoperative period, which signifies adequate pain management. This study supports the findings of a recent study by Macaire *et. al.* on postoperative opioid consumption after open cardiac surgery[1].

Erector spinae plane (ESP) block is a regional anesthesia technique originally used for the treatment of chronic thoracic neuropathic pain described by Forrero *et al*.[6] Moreover, a recent study has documented that ESP can also be used to provide postoperative analgesia in patients undergoing cardiac surgery[7].

Neuraxial anesthesia (NA) technique has been commonly used by many authors in cardiac surgery, which facilitates fast tracking and early extubation in ICU along with shorter ICU stay[8]. In patients undergoing cardiac surgery, a most important concern in using NA techniques remains the risk of epidural hematoma in patients taking antiplatelet agents, intraoperative systemic anticoagulation and cardiopulmonary bypass-induced coagulopathy[9].

The multimodal analgesia regimen has shown good results for postoperative pain; however, it may not provide complete analgesia. The use of perioperative opioids produces known side effects such as nausea/vomiting, pruritus, respiratory depression, postoperative chronic opioid use and increased risk of chronic pain resulting in poor quality of life[5]. A recent study[10] has stated that exposure to high-dose opioids during the perioperative period may predispose patients to readmission. So, we recommend using the ESP block technique in all adult cardiac surgical patients as it significantly reduces the overall opioid consumption and it also significantly allays pain thereby contributing to the patient's comfort and satisfaction.

This study has some limitations, which mainly are related to a low number of study patients. In addition, the spread of local anesthetic solution was not analyzed. We also recommend conducting further studies in the pediatric population as well in the future.

CONCLUSIONS

Erector spinae plane block is superior to the conventional opioid injection method for postoperative pain management in adult cardiac surgical patients. ESP block not only decreases the overall opioid consumption but also the NRS score in these patients.

ACKNOWLEDGEMENTS

Sources of Support and Funding: Department of Cardiac Anesthesia, Shahid Gangalal National Heart Centre, Bansbari, Kathmandu, Nepal

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Macaire P, Ho N, Nguyen T. Ultrasound-Guided Continuous Thoracic Erector Spinae Plane Block Within an Enhanced Recovery Program Is Associated with Decreased Opioid Consumption and Improved Patient Postoperative Rehabilitation After Open Cardiac Surgery — A Patient-Matched, Controlled Before-and-After Study. 2018;000.
2. Cogan J. Pain management after cardiac surgery. Semin Cardiothorac Vasc Anesth 2010; 14:201–4.
3. Sun L, Li Q, Wang Q, Ma F, Han W, Wang M. Bilateral thoracic paravertebral block combined with general anesthesia vs. general anesthesia for patients undergoing off-pump coronary artery bypass grafting: A feasibility study. BMC Anesthesiol 2019; 19:1–7.
4. Kopp SL, Smith HM, Kopp SL, Smith HM. Paravertebral Blockade. Mayo Clin Atlas Reg Anesth Ultrasound-Guided Nerve Blockade 2010; 50(October 1994):323–30.
5. Fletcher D, Martinez V. Opioid-induced hyperalgesia in patients after surgery: a systematic review and a meta-analysis. British journal of anaesthesia. 2014 Jun 1;112(6):991-1004.
6. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The erector spinae plane block a novel analgesic technique in thoracic neuropathic pain. Reg Anesth Pain Med 2016; 41:621–7.
7. Noss C, Anderson KJ, Gregory AJ. Erector spinae plane block for open-heart surgery: a potential tool for improved analgesia. J Cardiothorac Vasc Anesth 2019; 33:376–7. Available from: https://doi.org/10.1053/j.jvca.2018.07.015
8. Phulli R, Arora P, Neema PK. Utility and futility of central venous catheterization. Annals of cardiac anaesthesia. 2021 Jul 1;24(3):378-80.
9. Ho AMH, Chung DC, Joynt GM. Neuraxial blockade and hematoma in cardiac surgery: Estimating the risk of a rare adverse event that has not (yet) occurred. Chest 2000; 117:551–5. Available from: http://dx.doi.org/10.1378/chest.117.2.551.
10. Long DR, Lihn AL, Friedrich S, Scheffenbichler FT, Safavi KC, Burns SM, et al. Association between intraoperative opioid administration and 30-day readmission: a pre-specified analysis of registry data from a healthcare network in New England. Br J Anaesth 2018; 120:1090–102. Available from: https://doi.org/10.1016/j.bja.2017.12.044.