

BACKGROUND

- Uncontrolled postoperative pain from sternal incisions causes prolonged intubation, impairs surgical recovery, and can lead to the development of chronic pain syndromes, with reports of incidence varying between 11 - 56% at one-year follow up.¹
- Early adequate pain control, especially in the immediate postoperative period, may enable faster surgical recovery as well as improve patient experience.¹
- Recently, the erector spinae plane (ESP) block and the ultrasound-guided pecto-intercostal fascial (PIF) plane block have been used for multimodal analgesia during sternotomy.^{2,3}

STUDY AIMS

- The purpose of this study is to compare the post surgical analgesic efficacy of bilateral ESP blocks, bilateral PIF blocks, and no blocks in patients undergoing cardiac surgical procedures via sternotomy.
- The primary endpoint is opioid consumption (in mg IV morphine equivalents [MME]) during post operative days (POD) 0, 1, 2, 3, 4, and 5. Secondary endpoints include ICU length of stay (LOS), total postoperative LOS, and nausea/vomiting after extubation.

METHODS

- This prospective randomized control trial received approval from the IRB at the Icahn School of Medicine at Mount Sinai in New York City.
- Inclusion criteria included patients of all genders, ages 18 - 85, undergoing cardiac surgical procedures involving median sternotomy; exclusion criteria included patients ASA class V, urgent or emergent surgeries, contraindications to administration of local anesthesia, and history of disordered substance use or chronic opioid use.
- Patients were assigned randomly using a computer-generated table of numbers to either the ESP, PIF, or control groups.
- Univariate analyses were assessed using t tests for numerical values and chi square tests for categorical values.

RESULTS

	Control (N=75)	ESP (N=75)	PIF (N=75)	<i>p-value</i>	Total (N=225)
Baseline Variables					
Age (mean)	64.2 (SD 8.41)	63.7 (SD 10.8)	65.1 (SD 8.46)	0.637	64.3 (SD 9.26)
Gender				0.390	
Female	17 (22.7%)	11 (14.7%)	12 (16.0%)		40 (17.8%)
Male	58 (77.3%)	64 (85.3%)	63 (84.0%)		185 (82.2%)
BMI (mean)	27.8 (SD 4.51)	27.0 (SD 4.68)	28.7 (SD 5.98)	0.152	27.8 (SD 5.12)
Tobacco Use				0.638	
Former Use	35 (46.7%)	27 (36.0%)	31 (41.3%)		93 (41.3%)
Current Use	6 (8.0%)	9 (12.0%)	10 (13.3%)		25 (11.1%)
Alcohol Use	5 (6.7%)	6 (8.0%)	6 (8.0%)	0.938	17 (7.6%)
Recreational Drug Use	2 (6.7%)	4 (13.3%)	3 (10.0%)	0.726	9 (10.0%)
Hypertension	59 (78.7%)	59 (78.7%)	59 (78.7%)	1.000	177 (78.7%)
Hyperlipidemia	59 (78.7%)	55 (73.3%)	57 (76.0%)	0.746	171 (76.0%)
Diabetes	35 (46.7%)	41 (54.7%)	41 (54.7%)	0.527	117 (52.0%)
Asthma	5 (6.7%)	7 (9.3%)	6 (8.0%)	0.834	18 (8.0%)
Ejection Fraction (mean)	55.5 (SD 9.18)	51.2 (SD 13.9)	53.8 (SD 11.3)	0.100	53.5 (SD 11.8)

Table 1: Comparison of Control, ESP, and PIF treatment groups across baseline variables

	Control (N=75)	ESP (N=75)	<i>p-value</i>	PIF (N=75)	<i>p-value</i>	Total (N=225)
Outcome Variables						
MME POD0 (mean)	3.21 (SD 3.62)	3.32 (SD 3.57)	0.952	4.02 (SD 4.62)	0.758	3.52 (SD 3.97)
MME POD1 (mean)	21.4 (SD 21.0)	22.5 (SD 19.5)	0.740	25.0 (SD 19.9)	0.283	23.0 (SD 20.1)
MME POD2 (mean)	22.2 (SD 21.3)	18.8 (SD 18.0)	0.159	21.8 (SD 18.8)	0.262	20.9 (SD 19.4)
MME POD3 (mean)	15.7 (SD 19.0)	9.48 (SD 13.5)	0.015	11.9 (SD 12.6)	0.019	12.3 (SD 15.4)
MME POD4 (mean)	8.27 (SD 11.1)	7.76 (SD 13.5)	0.710	9.19 (SD 13.8)	0.885	8.41 (SD 12.8)
MME POD5 (mean)	7.77 (SD 13.5)	7.59 (SD 13.2)	0.914	6.34 (SD 12.0)	0.360	7.25 (SD 12.9)
ICU LOS (mean, days)	3.29 (SD 1.73)	3.33 (SD 2.17)	0.898	2.97 (SD 1.79)	0.289	3.20 (SD 1.90)
Total LOS (mean, days)	6.56 (SD 3.07)	6.88 (SD 2.82)	0.485	6.43 (SD 2.80)	0.767	6.62 (SD 2.89)
Postoperative nausea	14 (18.7%)	14 (18.7%)	1.000	9 (12.0%)	0.261	37 (16.4%)

Table 2: Comparison of Control vs. ESP and Control vs. PIF treatment groups across outcome variables

RESULTS (CONTINUED)

- 225 patients were included; 75 received an ESP block, 75 received a PIF block, and 75 were controls.
- Univariate analyses demonstrated no significant differences in demographics or baseline characteristics between treatment groups (**Table 1**).
- Outcomes analyses indicate that ESP and PIF blocks were associated with less MME use on POD 3 (control 15.7 MME; ESP 9.48 MME, p = 0.015; PIF 11.9 MME; p = 0.019) (**Table 2**).
- Outcomes analyses demonstrated no significant differences in post-operative opioid consumption measured in MME on POD 0, 1, 2, 4, or 5 between either treatment group and control (**Table 2**).
- Analysis of secondary endpoints demonstrated no significant difference in ICU LOS, total LOS, or incidence of postoperative nausea.

CONCLUSIONS

- On POD 3, patients who received ESP or PIF blocks had significantly lower opioid consumption than patients who did not receive a block. On subsequent PODs 4-5, there is no significant difference in opioid consumption.
- These results indicate that the administration of ESP or PIF blocks during sternotomy may result in more effective pain control than the control group, before all groups level out to <10 MME on PODs 4 and 5.
- Our results show a possible delayed benefit on POD 3, well after the expected duration of the block. One possible explanation for this time course is the lag between DOS and the peak of the postoperative inflammatory response, which has previously been found to be between PODs 1-3.⁴ Nerve blocks may decrease the magnitude of the inflammatory peak, leading to decreased opioid requirement..

REFERENCES

- Fregoso G, Wang A, Tseng K, Wang J. Transition from Acute to Chronic Pain: Evaluating Risk for Chronic Postsurgical Pain. Pain Physician. 2019 Sep;22(5):479-488. PMID: 31561647.
- King M, Stambulic T, Servito M, Mizubuti GB, Payne D, El-Diasty M. Erector spinae plane block as perioperative analgesia for midline sternotomy in cardiac surgery: A systematic review and meta-analysis. J Card Surg. 2022 Dec;37(12):5220-5229. doi: 10.1111/jocs.17005. Epub 2022 Oct 11. PMID: 36217996.
- Kumar AK, Chauhan S, Bhoi D, Kaushal B. Pectointercostal Fascial Block (PIFB) as a Novel Technique for Postoperative Pain Management in Patients Undergoing Cardiac Surgery. J Cardiothorac Vasc Anesth. 2021 Jan;35(1):116-122. doi: 10.1053/j.jvca.2020.07.074. Epub 2020 Jul 30. PMID: 32859487.
- Ito A, Hara T, Irie H. Postoperative C-reactive protein levels correlate with reduced spinal column mobility after median sternotomy: a prospective cohort study. J Thorac Dis. 2024 Jan 30;16(1):469-478. doi: 10.21037/jtd-23-1439. Epub 2024 Jan 12. PMID: 38410601; PMCID: PMC10894417.