

Implementation of Pectoralis and Serratus Anterior Plane Blocks for Analgesia in Minimally Invasive Robotic Mitral Valve Repair: A Quality Improvement Initiative

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Introduction

- Effective postoperative pain control is a cornerstone of recovery following cardiac surgery. Inadequate analgesia has been linked to prolonged mechanical ventilation, longer intensive care unit (ICU) admissions, increased complications, and decreased patient satisfaction [1]. Although opioids remain the standard for postoperative analgesia, their use is associated with adverse effects such as respiratory depression, nausea, ileus, and urinary retention.
- Prior research demonstrates that fascial plane nerve blocks (FPBs) are efficacious in pain control for abdominal and thoracic surgeries and are increasingly incorporated into multimodal analgesic protocols for cardiac procedures. Optimized analgesia is associated with early extubation, improved clinical outcomes, reduced ICU length of stay, and greater cost-effectiveness [2].
- The primary aim of this quality improvement initiative was to reduce time to extubation, ICU length of stay, and postoperative opioid requirement utilizing chest wall FBPs in cardiac surgery patients.

Methods and Materials

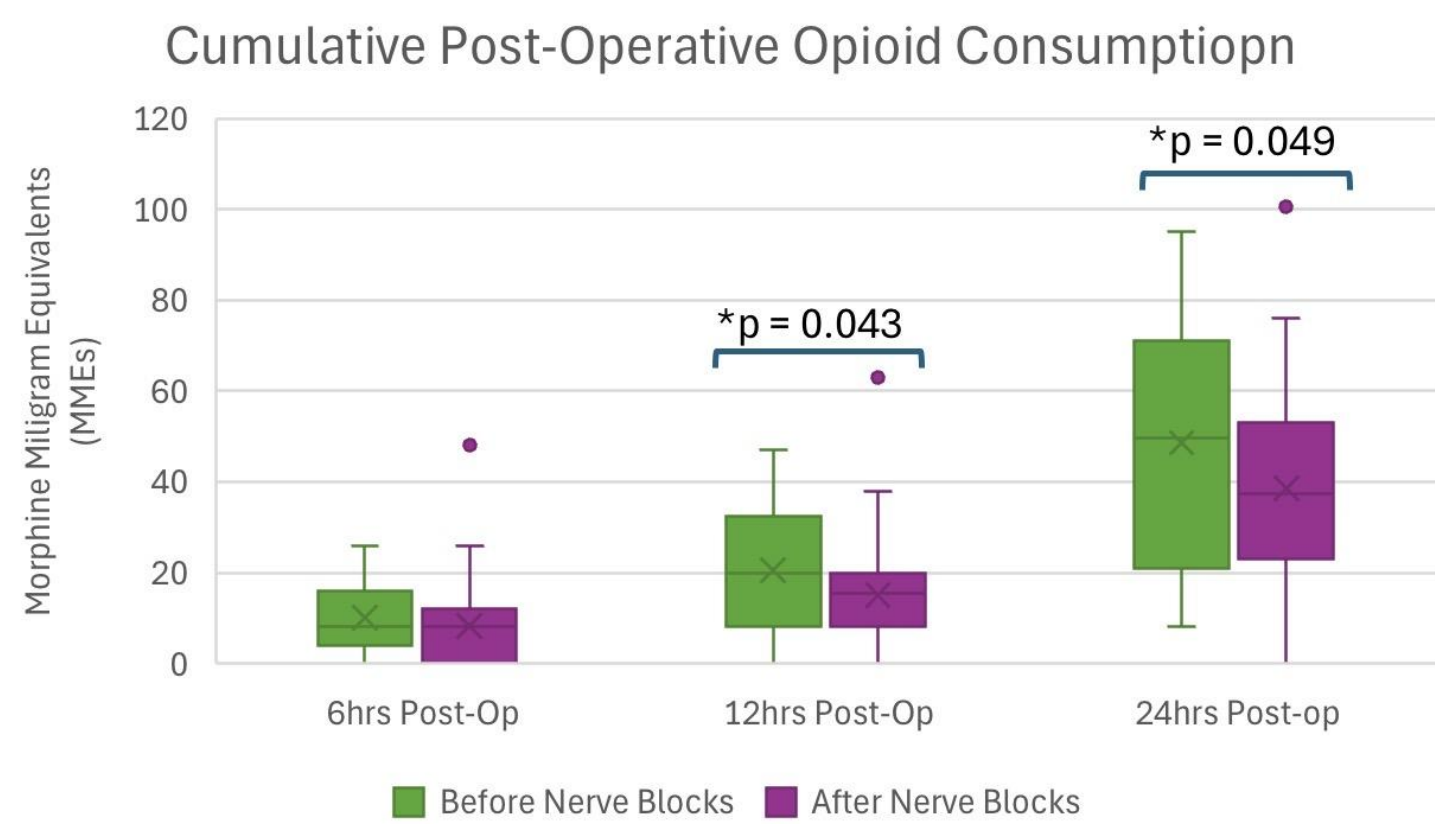
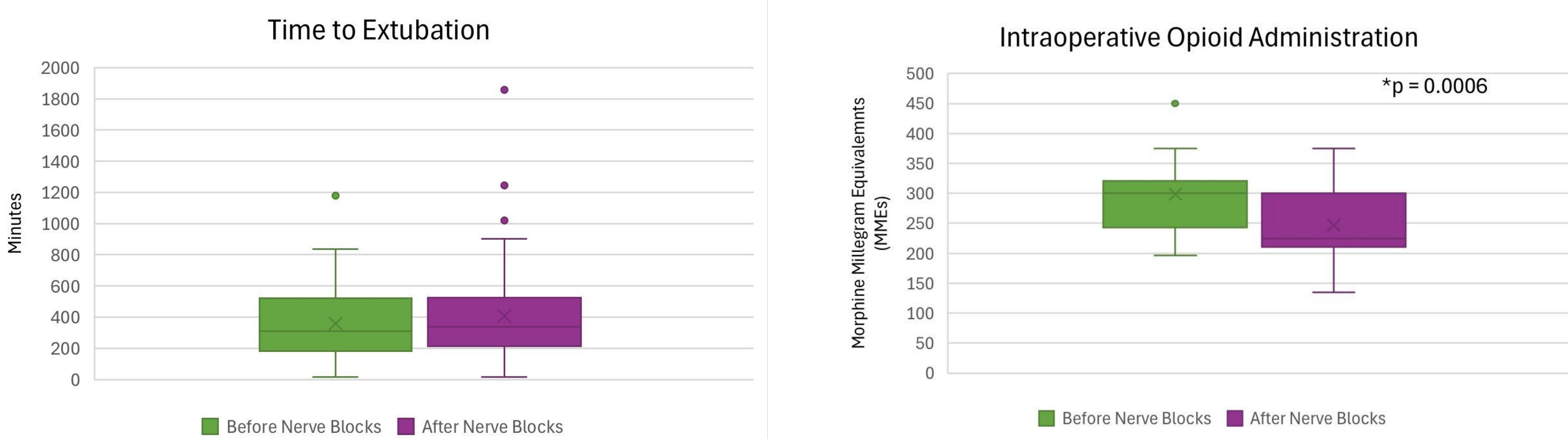
- Following induction of general anesthesia, ultrasound-guided right pectoralis II and/or serratus anterior plane nerve blocks were performed using 40-60 mL of ropivacaine 0.2% with 4mg preservative free dexamethasone.
- Data was obtained from 12 months prior and 12 months following initiation of this protocol, with total sample size of 69 patients.
 - Exclusion criteria: a) robotic surgery was converted to open intraoperative, b) return to operating room within 24 hours
- Extubation times, pain scores, and morphine milligram equivalents (MME) were collected from chart review at set intervals for the first 24 hours postoperatively.

Table 1. Baseline Demographics of Study Participants

	Before Regional Nerve Block Implementation (n = 26)	After Regional Nerve Block Implementation (n = 43)
Age (years), mean ± SD	60.11 ± 11.53	64.12 ± 11.0
Gender, N (%)		
Male	19 (73.1%)	26 (60.5%)
Female	7 (26.9%)	17 (39.5%)
BMI (kg/m ²), mean ± SD	28.07 ± 5.65	26.85 ± 4.25
ASA Class, mean ± SD	3.23 ± 0.43	3.28 ± 0.50

Results

- A total of 69 patients were included in data analysis after excluding 3 patients
- Average time to extubation was 356.77 minutes (n=26) prior to initiation of the chest wall nerve block protocol and 407.81 minutes (n=46) (p-value 0.55) after implementation.
- There was also no significant difference in ICU length of stay (p = 0.320), average pain scores from 6-12 hours post-operatively (p = 0.317), or average pain scores from 12-24 hours post-operatively (p = 0.151) between the groups.
- Patients who received chest wall nerve blocks did receive less opioid intraoperatively, (p- value 0.000554).
 - Received nerve blocks: 246 MMEs
 - Did not receive nerve blocks: 298 MMEs
- There was a statistically significant difference in total opioid use at 12 and 24 hours, (p-value 0.040) and (p-value 0.049), respectively.
 - 12 hours
 - Received nerve blocks: 15.11 MMEs
 - Did not receive nerve blocks: 20.46 MMEs
 - 24 hours
 - Received nerve blocks: 38.6 MMEs
 - Did not receive nerve blocks: 48.9 MMEs



*P-values are reported descriptively to characterize differences between periods and are not intended for hypothesis-driven inference

Discussion

- Prior to this initiative, cardiac surgery patients did not routinely receive regional anesthesia.
- Although chest wall fascial plane nerve blocks reduced intraoperative and post-operative opioid administration, this did not translate clinically to improved pain scores, earlier extubation times or reduced ICU length of stay in this patient population.
- There was a large amount of heterogeneity in the type chest wall nerve block performed
 - Some patients received Pec II block only
 - Some patients received Serratus anterior plane block only
 - Some patients received both PEC II and Serratus anterior plane nerve blockFurther initiatives should look to standardize the type of regional anesthesia provided to determine if one modality is superior than the rest.
- Future initiatives should assess for other factors that can impact extubation and ICU stay such as surgical complications, hemodynamic instability, or institutional bed availability.

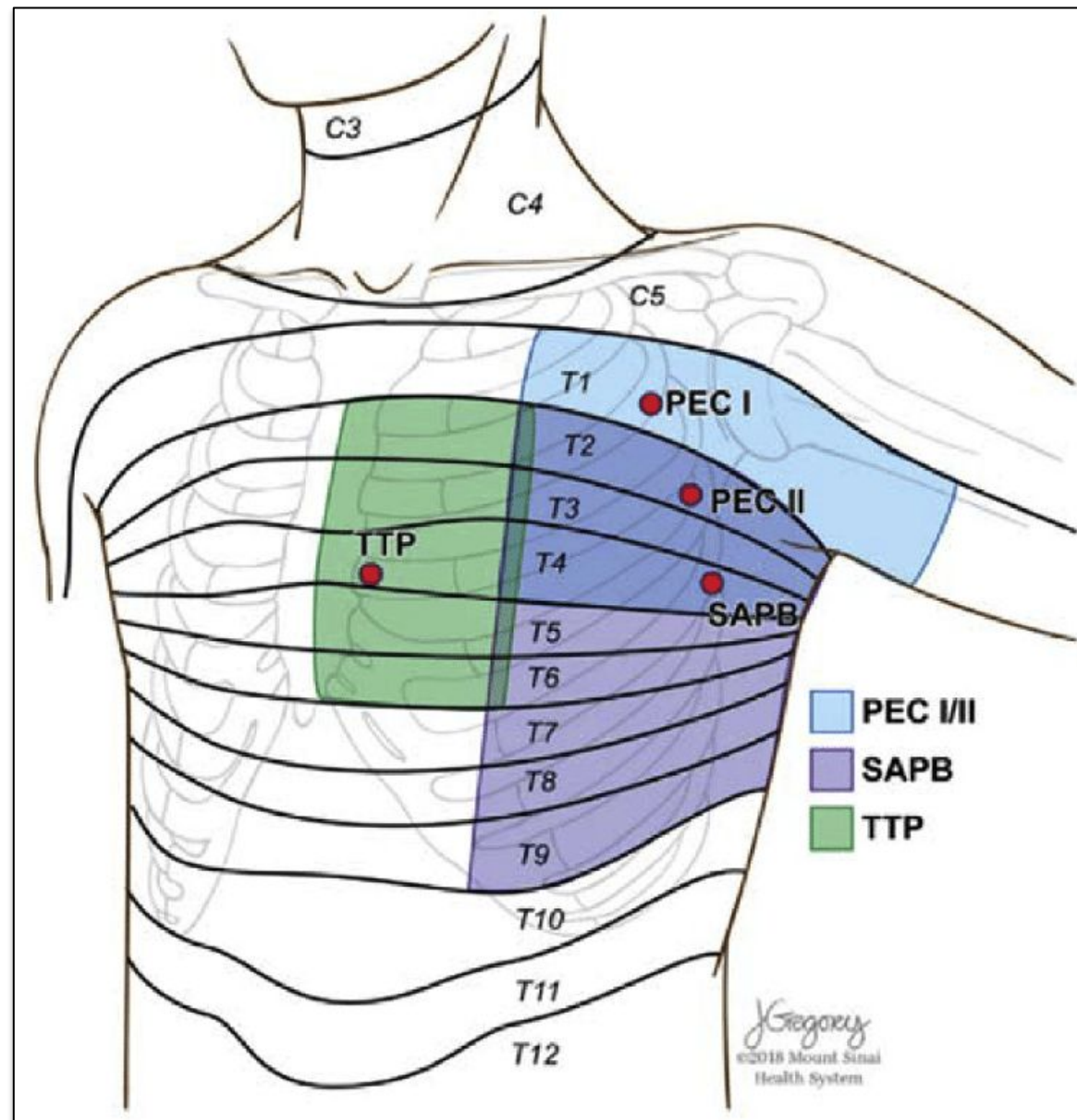


Figure 1: Illustration of the anterior chest wall and respective dermatomal distributions of expected sensory block for common chest wall nerve blocks [3].

References

- Kar P, Ramachandran G. Pain relief following sternotomy in conventional cardiac surgery: A review of non neuraxial regional nerve blocks. Ann Card Anaesth. 2020 Apr-Jun;23(2):200-208. doi: 10.4103/aca.ACA_241_18. PMID: 32275036; PMCID: PMC7336989.
- Ge Y, Chen Y, Hu Z, Mao H, Xu Q, Wu Q. Clinical Evaluation of on-Table Extubation in Patients Aged Over 60 Years Undergoing Minimally Invasive Mitral or Aortic Valve Replacement Surgery. Front Surg. 2022 Jun 29;9:934044. doi: 10.3389/fsurg.2022.934044. PMID: 35846953; PMCID: PMC9280709.
- Liu H et al., Regional anesthesia considerations for cardiac surgery, Best Practice & Research Clinical Anaesthesiology, <https://doi.org/10.1016/j.bpa.2019.07.008>