Enhanced Recovery After Cardiac Surgery: Addressing Pain Management in CVICU to Improve Outcomes at the University Medical Center of Southern Nevada

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BACKGROUND

Pain management is critical to enhancing patient safety and quality of care for those admitted to critical units due to severe health conditions requiring surgery. The use of opioid and nonopioid pain modulators requires systematic pain assessments and monitoring in the reduction of adverse effects post-operatively. More is driven by the increased risks of prolonged pain when using opiates before surgery and after surgery and the high burden of **ORADE – Opioid-Related Adverse Drug Events** (Small & Laycock, 2020) such as sedation, respiratory issues, nausea, vomiting, and ileus. These aspects call for a **multimodal strategy for using analgesics** to minimize opioid use and attenuate opioid-induced hyperalgesia.

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PURPOSE

The project aims to improve postoperative pain management among CS patients in the CVICU at the project site based on the ERAS protocol. Specifically, the project aims to **implement a multimodal pain management protocol whose goal is to reduce postoperative opioid use while maintaining optimal pain control.** Ultimately, the project aims to achieve a sustainable evidence-based pain management algorithm to enhance postoperative recovery and promote the rational use of opioids for overall patient safety.

Project Objectives

1. Implement an evidence-based multidisciplinary ERAS protocol for postoperative pain management CS patients
2. Implement a change in the order set in Epic in collaboration with the EHR system to introduce the utilization of non-opioid pain modulators
3. Reduce the pain scores in POD 1-3 with the use of the new protocol
4. Increase the use of non-opioid pain management on POD 0 and reduce IV opiate use by POD3

METHODS

The implementation framework utilized for this project is **Plan-Do-Study-Act Model.**

Population: The QI project included **healthcare provider staff working at the CVICU** at the selected project site, part of the Critical Care Services and Perioperative Service. The project involved CVICU pharmacists, cardiothoracic NPs, and nurses.

Setting: The QI project was implemented at a short-term acute care facility situated in Las Vegas, Nevada. This government-owned, county-operated hospital has a total of 537 staffed beds, specializing in various acute care services. The selected project site is the largest public hospital in Nevada, serving as the Metropolitan Anchor Hospital for Las Vegas and the surrounding southern Nevada area (AHA, 2024).

Human Subjects Protection

The participants in this project will include healthcare providers from the CVICU, such as nurses, NPs and pharmacists. There will be no interaction with patients, nor will any patient-level data be collected, further safeguarding confidentiality and ethical standards. As for the project site, ethics IRB approval was obtained provided that chart reviews will be **limited to a total of 30 patient charts.**

For the Intervention, a **postoperative pain management ERAS protocol** was created based on best practices and evidence-based recommendations. The regimen provided in the protocol was used to modify the order set in Epic in coordination with the EHR team (Table 1).

ERAS Protocol for Postoperative Management using Multimodal Analgesia in the CVICU

The ERAS protocol for postoperative pain management for CVICU patients using multimodal analgesia is based on the ERAS guidelines (Engelman et al., 2019) and stakeholder perspectives. In line with this, an order set was developed based on the study by Loria et al., 2022, implementing the postoperative pain management protocol cited. This developed order set will be integrated into the EHR system by coordinating with the IT staff.

Validation of Tools

To validate the project tools, a structured approach was employed. The ERAS protocol for postoperative pain management underwent expert review by the multidisciplinary team, including anesthesiologists, cardiothoracic surgeons, CVICU NPs, and CVICU nurses to ensure alignment with current guidelines (Engelman et al., 2019; Loria et al., 2022). Feedback from the CVICU staff was gathered through informal interviews to confirm the practical implementation of the protocol. A pilot test of the protocol and order set will be conducted to make any adjustments as necessary.

Table 1. Drugs involved in ERAS protocol for postoperative management and their mode of administration (Loria et al., 2022)

Drug (dose)	Instruction for Administration
Scheduled	
Acetaminophen 1000 mg IV	Administered once at post-op floor
Acetaminophen 1000 mg tablet	Scheduled every 6 hours for 5 days at post-op floor
Gabapentin 100 mg capsule	PO TID for 5 days at post-op floor
Drugs as needed for Mild pain	
Acetaminophen 650 mg tablet	PO scheduled every 4 hrs PRN x mild pain (post-extubation) at post-op floor
Acetaminophen 650 mg suppository	Rectal every 4 hrs PRN x mild pain (post-extubation) at post-op floor
Drugs as needed for Moderate to Severe pain	
Oxycodone IR 5 mg tablet	PO every 4 h-PRN moderate pain (PS 4-6) (post-extubation) at post-op floor
Oxycodone IR 10 mg tablet	PO every 4 h-PRN severe pain (PS 7-10) (post-extubation) at post-op floor
Morphine 2 mg IV injection	Administer over 5 minutes every 4 hours PRN x severe pain (PS 7-10) (post-extubation) at post-op floor
Fentanyl IV injection	If allergic to morphine, administer every 2 hours as needed for moderate to severe pain (post-extubation) at post-op floor
Others	
Lidocaine 5% transdermal patch	Applied to bilateral back or chest PRN

Printed and online copies of the developed protocol were disseminated to the CVICU staff. Training to the new protocol was held among CVICU staff to ensure adherence to the new protocol and compliance to the order set.

DATA COLLECTION

Data collection the project involved reviewing 30 patient charts, split equally between pre- and post-implementation phases, with one post-implementation chart excluded due to missing pain scores, resulting in a **final sample size of 29.** Data abstraction was conducted using a standardized sheet and included patient demographics, medications ordered per postoperative day (POD), average pain scores, surgery details, complications, disposition, and discharge dates. The data were organized in a master spreadsheet using Microsoft Excel.

DATA EVALUATION

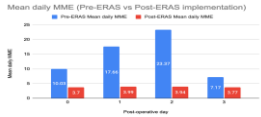
Evaluation of the data involved analyzing each variable to assess the impact of the implemented intervention. **Provider compliance** with the ERAS protocol was measured using frequency and proportion analysis to determine adherence to the updated Epic order set. **Pain scores POD** were evaluated by calculating the average pain scores for each POD, with statistical comparisons conducted between pre- and post-implementation groups to assess differences. **Opioid use** was analyzed by calculating the **morphine milligram equivalent (MME) scores** for each patient per POD, as well as overall MME scores, with comparisons performed between the two phases to identify changes in opioid utilization.

RESULTS

Under the pre-implementation phase, a total of 13 charts were non-compliant to the ERAS protocol while 2 were compliant. For the post-implementation phase, all charts were compliant to the ERAS protocol (Table 3). Fischer's exact test was used for analysis (Schnell, n.d.) Upon analysis, it was found that **there is an association between the modification of the order set in Epic and provider compliance with the ERAS protocol (p < 0.001)**

Table 3. Provider Compliance to ERAS Protocol Contingency Table and Fisher's Exact Test Results

	Non-compliant (%)	Compliant (%)	Total (%)	Fisher's Exact Test p-value
Pre-implementation	13	2	15	< 0.001
Post-implementation	0	14	14	
Total	13 (44.8)	16 (55.2)	29 (100)	



Under the pre-implementation phase, the overall mean pain score from POD 0-3 was 6.80 (std dev: 1.13). For the post-implementation phase, the overall mean pain score was 6.52 (std dev 1.46). There was a decreasing trend in pain scores from POD 0-3 (Figure 1). Although, relatively lower mean daily pain scores were obtained in the post-implementation phase, **there is no significant difference between the overall mean pain score between the 2 groups (p=0.573).**

Under the pre-implementation phase, the overall mean IV MME from POD 0-3 was 14.55 (std dev: 4.14). Opioid utilization was highest at POD 2 with a mean MME of 23.37For the post-implementation phase, the overall mean IV MME was 5.80 (std dev 4.66) with a relatively more constant mean daily MME from POD 0-3. **There is a significant difference between the overall mean MME scores between the 2 groups (p<0.001)**

CONCLUSIONS

Modifying Epic order sets to align with the **ERAS protocol significantly improved provider compliance (p < 0.001) and reduced opioid use (p < 0.001).** No significant reduction in pain scores (p = 0.573), but pain control remained consistent despite reduced opioid use. **Findings highlight the effectiveness of multimodal pain management strategies in improving provider compliance and reducing opioid use.** Integration of ERAS order sets into Epic promotes long-term adherence and consistency across CVICU providers.

PROJECT LIMITATIONS

- Selection bias may have occurred due to the small sample size (n=29) and inclusion of patients from a single CVICU, limiting generalizability. The small sample size also reduced statistical power, increasing the risk of Type II errors—when a test fails to detect an existing effect (Sullivan et al., 2016).
- The pre-post design without randomization limited control over confounding variables, affecting validity. Data abstraction relied on Epic documentation, introducing variability based on provider habits. Adjustments, such as using Fisher's Exact Test instead of Chi-square, addressed these limitations.
- To minimize these issues, standardized data abstraction sheets ensured consistent data collection. Providers received education on Epic documentation and the ERAS protocol to reduce variability. Statistical methods were adjusted based on data characteristics for robust analysis.

SUSTAINABILITY AND FUTURE DIRECTIONS

The project site is committed to sustaining ERAS protocol use for postoperative pain management. Barriers include resistance to change, training gaps, and workflow integration challenges. Sustaining improvements will require ongoing role-specific training, technical support for Epic-related issues, and stakeholder engagement to address resistance. Periodic audits and feedback will further support adherence and smooth workflow integration.

REFERENCES

See poster author for reference list.

PATHWAY DESIGNATED