From Reactive to Proactive: A Nurse-Led PACU Medication Sequencing Model to Improve Postoperative Pain Outcomes After Total Joint Arthroplasty

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A noticeable increase in postoperative pain scores and intravenous (IV) opioid rescue medication consumption among total joint arthroplasty patients in the post-anesthesia care unit (PACU) prompted concern among bedside nurses at our facility. Patients recovering from total hip and knee replacement were arriving with higher pain scores and requiring more frequent and often higher doses of IV opioid administration, a pattern that contributed to hypotension, nausea and delayed readiness for early ambulation which could jeopardize same day discharge. These shifts were subtle initially but became increasingly evident in daily workflow and patient recovery patterns.

The clinical change followed a required regulatory modification to the intraoperative periarticular infiltration (PAI) protocol. To ensure compliance with updated compounding standards, the intraoperative analgesic formulation transitioned from a multi-agent cocktail to a single agent ropivacaine solution. The change was necessary and unavoidable. However, although regulatory compliance was achieved, PACU nurses began observing downstream effects in postoperative pain management.

Total joint arthroplasty pathways emphasize multimodal analgesia, opioid stewardship, and early mobilization. Effective pain control in the immediate postoperative period reduces nausea and hypotension, supports participation in physical therapy, and facilitates discharge readiness. Increased reliance on IV opioid rescue medications raised concerns not only about comfort, but about sedation, orthostatic instability, and delayed recovery.

Sequential chart review confirmed clinical observations. Compared with the original multi-agent PAI cohort, patients receiving ropivacaine-only PAI demonstrated higher PACU arrival pain scores and increased IV opioid consumption. No significant changes in surgical technique, anesthesia management, or enhanced recovery pathways occurred during this period. The primary difference was the intraoperative analgesic formulation.

While formulation changes were outside nursing control, postoperative medication sequencing was not.

Development of a Structured PACU Sequencing Model

PACU nurses identified variability in how analgesics were initiated and escalated. In practice, IV opioid rescue was sometimes administered before adequate trials of oral medication and multimodal adjuncts. Reassessment timing was inconsistent, and adjunct therapies were not always layered in a structured manner. Although care was appropriate and within existing orders, the approach lacked deliberate sequencing. The model emphasized:

- Administration of oral opioid analgesia within 30 minutes of PACU arrival
- Targeted use of IV methocarbamol for suspected muscle-mediated discomfort
- Consideration of magnesium sulfate as an adjunct (although literature supports this being administered preoperatively or intraoperatively for optimal effectiveness)
- Defined reassessment intervals prior to escalation
- Reservation of IV opioid administration for persistent pain scores greater than six
- Timely redosing of acetaminophen when clinically appropriate

The goal was to shift practice from reactive rescue dosing to proactive multimodal layering. Education was provided

Through interdisciplinary collaboration and a nurse-led workflow redesign, a structured PACU medication sequencing model was successfully implemented. When combined with enhanced intraoperative analgesia, this approach reduced IV opioid rescue administration while improving postoperative pain outcomes, including patient satisfaction, timely ambulation and discharge home.

to PACU staff, and sequencing expectations were incorporated into daily workflow discussions.

Outcomes Across Sequential Practice Phases

The ropivacaine-only cohort demonstrated the highest reliance on IV opioid administration. With the introduction of intraoperative RECK (ropivacaine, epinephrine, clonidine and ketorolac) baseline analgesia improved. However, the most favorable outcomes were observed after implementation of structured PACU sequencing in combination with RECK.

Across these phases, IV opioid administration in the PACU declined substantially from peak levels observed after the ropivacaine-only transition. In the final cohort, IV opioid rescue rates were reduced by more than half compared with the immediate post-transition phase. This reduction was clinically meaningful, given the association of IV opioids with hypotension, nausea, sedation, and delayed ambulation.

Importantly, improved IV opioid stewardship did not occur at the expense of pain control. Mean PACU discharge pain scores decreased in the final cohort compared with earlier phases. Postoperative day seven pain scores also demonstrated sustained improvement. By postoperative day fourteen, most patients reported successful transition to non-opioid analgesics, including acetaminophen and nonsteroidal anti-inflammatory medications.

These findings suggest that enhanced intraoperative analgesia (RECK) established a stronger baseline, while structured PACU sequencing optimized postoperative management. The combination produced the most consistent improvements in both pain trajectory and IV opioid reliance.

Implications for Nursing Practice

This initiative underscores the influence of nursing workflow on postoperative outcomes. Although intraoperative analgesic formulation shapes early pain presentation, PACU sequencing determines how that pain is addressed. Standardized sequencing reduces variability and supports safer ambulation and discharge readiness. Early oral opioid initiation, disciplined multimodal layering, and defined IV rescue thresholds reduced variability in care delivery and supported opioid stewardship without compromising comfort. This aligns with national efforts toward opioid-sparing postoperative care and reinforces the central role of nursing in implementation. Embedding sequencing as the default practice reduced variability and reinforced accountability.

The sequencing model requires no additional equipment or advanced technology. It relies on assessment, timing, pharmacologic understanding, and consistent reassessment—core nursing competencies. Because the model is structured yet adaptable, it may be reproducible in other institutions regardless of specific PAI formulation.

Limitations and Sustainability

This project was conducted as a quality improvement initiative within a single center using sequential cohorts. Formal statistical analysis was not performed. Early data were retrospective, with subsequent phases including prospective audit and monitoring. Despite these limitations, consistent sample sizes and stable surgical/anesthesia practices during the study period support meaningful clinical interpretation.

Sustainability efforts included incorporation of sequencing expectations into PACU orientation, reinforcement during staff education sessions, and ongoing monitoring of IV opioid utilization and pain scores. Future evaluation will focus on long-term adherence and outcome stability to ensure durable practice change.

Conclusion

A required regulatory change to intraoperative analgesia resulted in unintended increases in postoperative pain scores and IV opioid rescue. Through interdisciplinary collaboration and a nurse-led workflow redesign, a structured PACU medication sequencing model was successfully implemented. When combined with enhanced intraoperative analgesia, this approach reduced IV opioid rescue administration while improving postoperative pain outcomes, including patient satisfaction, timely ambulation and discharge home.

Standardizing early oral opioid administration, multimodal adjunct medication use, and defined escalation thresholds represents a practical, nurse-driven strategy to improve recovery after total joint arthroplasty. For PACU environments seeking to strengthen opioid stewardship while maintaining effective pain control, structured medication sequencing offers a replicable and clinically supported model. ■