

Abstract

Purpose: To evaluate the impact of implementing a multimodal plan of care in treating the pain of the postoperative cesarean birth patient that limited opioid exposure.

Study Design and Methods: A retrospective medical record review was conducted to evaluate a pain management protocol implemented for postoperative cesarean patients before and after a practice change. Sample included term postoperative cesarean patients ≥ 37 weeks of gestation, who had spinal or epidural, were 18 years or older, gave birth to a singleton newborn, admitted to the maternal child health department, and were prescribed opioids as a postoperative pain management treatment plan. Participants ($N = 150$) were evaluated based on two groups: $n = 75$ in the preimplementation group and $n = 75$ in the postimplementation group.

Results: There was a significant difference in the total oral opioid milligrams administered between the pregroup ($M = 27.13$) and postgroup ($M = 8.43$), after the practice change ($p < .001$). There was an increase of nonopioids administered to treat and manage postoperative cesarean pain, Motrin PO ($p = < .001$) and Tylenol PO ($p = .002$).

Clinical Implications: Fewer milligram equivalents of morphine were administered when postoperative cesarean patients were placed on scheduled nonopioids to treat pain.

Key words: Cesarean birth; Maternal health services; Morphine derivatives; Opioid-related disorders; Pain management; Postpartum period.

A MULTIMODAL PROTOCOL TO LIMIT OPIOID EXPOSURE AND EFFECTIVELY MANAGE POSTOPERATIVE CESAREAN BIRTH PAIN

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Approximately 136 Americans die daily from an opioid drug overdose (National Center for Drug Abuse Statistics, 2022). Some patients who are prescribed opioids for chronic noncancer pain misuse them and progress to develop an opioid use disorder (Shah et al., 2017). In 2020, approximately 142 million opioid prescriptions were written in the United States (Centers for Disease Control and Prevention [CDC], 2021). In 2017, the estimated opioid epidemic cost the United States over a billion dollars (Luo et al., 2021). With the impact of the opioid epidemic, there is a need to find alternative methods to manage postoperative pain that do not involve routinely prescribing opioids and include effective nonpharmacologic pain management techniques.

Women account for one-third of opioid-related overdose deaths in the United States (Cleveland et al., 2020). In 2021, the cesarean birth rate rose to 32.1% from 31.8% in 2020 (Hamilton et al., 2022). With over 1.2 million cesareans performed in the United States each year who are prescribed opioid analgesia during an inpatient cesarean stay and discharge, there are a significant number of women who could become potential persistent users (Macias et al., 2022). Inadequate treatment of cesarean pain in the early recovery phase can result in increased opioid use (Carvalho & Butwick, 2017).

In the United States, new persistent opioid use after exposure has increased among women after childbirth (Peahl et al., 2019). For some women of reproductive age, the initial exposure to opioids is from illicit use, and for many others, the exposure occurs in a hospital setting. Concerns about the rise in the rate of new persistent opioid use among women exposed in maternity units indicate

need for a practice change in managing pain after birth. The American College of Obstetricians & Gynecologists (2021) recommends a multimodal approach to help reduce use of opioids in the postpartum period.

An optimal approach for providing an effective postpartum analgesia treatment plan is significant in minimizing the risk of opioid misuse (Blitz et al., 2022). The goal is to decrease the overall need for opioids. A multimodal pain management plan of care is an alternative method to treating pain to reduce the risk of dependency and addiction. This alternative method includes scheduled nonsteroidal anti-inflammatory drugs and acetaminophen administered first, with opioids reserved for severe breakthrough pain (Sutton & Carvalho, 2017). Burgess et al. (2019) saw a 61% reduction in opioid administration in postcesarean patients after the implementation of a standardized comfort bundle, including preoperative acetaminophen.

Evidence has shown the benefits of a multimodal approach to postpartum pain management (Blitz et al., 2022; Burgess et al., 2019; Hedderson et al., 2019). However, despite this evidence, implementation is inconsistent in the obstetrics inpatient care setting. Therefore, we evaluated the impact of implementing a multimodal pain management treatment plan with acetaminophen and ibuprofen administered around the clock concurrently for postoperative cesarean patients who were eligible with the option of opioids for breakthrough medication in a single maternity care inpatient setting.

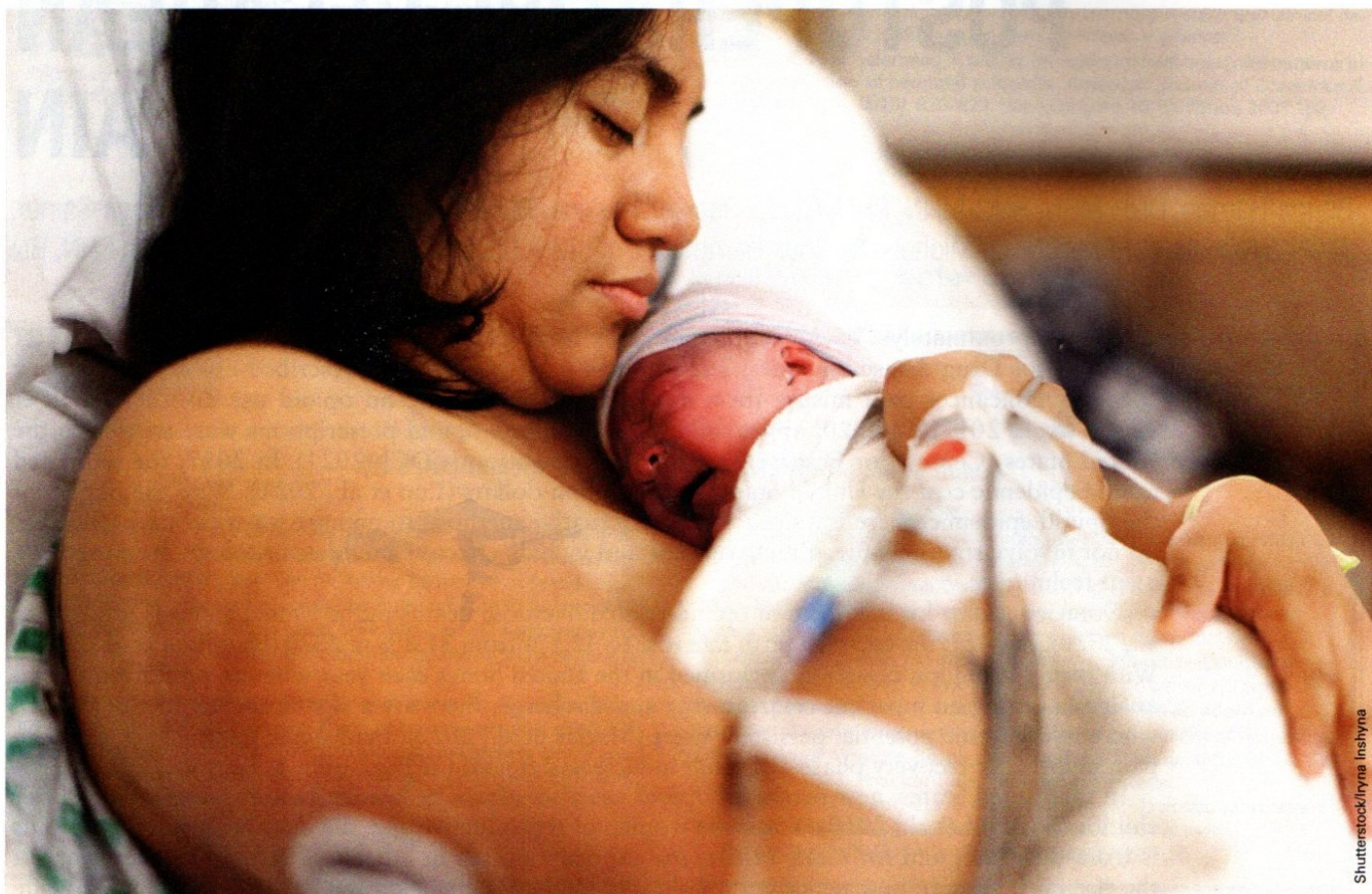
Study Design and Methods

A retrospective medical record review was conducted to evaluate a pain management protocol implemented for postoperative cesarean birth patients. See Table 1 for the pain management regimen for the pre- and postgroup. Data were collected before and after the practice change. Data collection began in May 2020 to December 2021. The practice change began in March 2020 and was fully implemented in April 2020. An IRB approval was granted for this project.

Setting

The project took place in the maternal child health department at Kaiser Permanente in Southern California, which serves the Inland Empire community. The inpatient acute-care facility is a teaching hospital with approximately 250 births a month and 3,000 births annually. The COVID-19 pandemic was the catalyst for implementing this facility's pain management practice change to standardize the perioperative care of obstetrical patients to improve maternal and fetal outcomes.

A multimodal protocol to manage postoperative cesarean pain can be an effective way to decrease the overall need for opioids.



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TABLE 1. PAIN MANAGEMENT REGIMEN BY PRE AND POST GROUP (BEFORE AND AFTER THE PRACTICE CHANGE)

Pregroup Pain Management Order (Standard Regimen)	
Mild Pain (Pain Scale 1–3)	• Motrin 600 mg PO every 6 hours (NOT AS NEEDED) • Administration instructions: Give scheduled not prn • Motrin 800 mg PO every 8 hours (NOT AS NEEDED) • Administration instructions: Give scheduled not prn • Tylenol 650 mg PO every 4 hours (AS NEEDED) OR (TEMPERATURE > 38° C) • Administration instructions: Do not exceed 4 GM/day from all acetaminophen products.
Moderate Pain (Pain Scale 4–6): To start 18 hours after Duramorph bolus in Labor & Delivery	• Norco 5/325 (Hydrocodone 5 mg/Acetaminophen 325 mg) 1 tab PO every 3 hours (AS NEEDED) • Percocet 5/325 (Oxycodone 5 mg/Acetaminophen 325 mg) 1 tab PO every 3 hours (AS NEEDED) • Administration instructions: Do not exceed 4 GM/day from all acetaminophen products.
Severe Pain (Pain Scale 7–10): To start 18 hours after Duramorph bolus in Labor & Delivery	• Norco 10/325 (Hydrocodone 10 mg/Acetaminophen 325 mg) 1 tab PO every 4 hours (AS NEEDED) • Norco 5/325 (Hydrocodone 5 mg/Acetaminophen 325 mg) 2 tabs PO every 6 hours (AS NEEDED) • Percocet 5/325 (Oxycodone 5 mg/Acetaminophen 325 mg) 2 tabs PO every 4 hours (AS NEEDED) • Administration instructions: Do not exceed 4 GM/day from all acetaminophen products.
Postgroup Pain Management Order (Multimodal Regimen)	
Ketorolac (Toradol) and Ibuprofen (Motrin) Orders: SCHEDULED	• Toradol 30 mg IV every 6 hours × 4 doses followed by Motrin 600 mg PO every 6 hours • Motrin 600 mg PO every 6 hours (NOT AS NEEDED) • Motrin 800 mg PO every 8 hours (NOT AS NEEDED) • Toradol 30 mg IV every 6 hours × 4 doses (Cr <1.5 and weight ≥ 50 kg) • Toradol 15 mg IV every 6 hours × 4 doses (Cr >1.5 and weight ≥ 50 kg) • Administration instructions: Give scheduled not prn effective upon patient's arrival to unit. • Check first for any previous administration and start 6 hours later if given.
Acetaminophen (Ofirmev and Tylenol) Orders: SCHEDULED	• Tylenol 650 mg PO every 6 hours (NOT AS NEEDED) • Ofirmev 1,000 mg IV every 6 hours × 1 followed by Tylenol 650 mg PO every 6 hours (For weight 50 kg and greater) • Ofirmev 750 mg IV every 6 hours × 1 followed by Tylenol 650 mg PO every 6 hours (For weight less than 50 kg) • Administration instructions: Give scheduled not prn. Do not exceed 4 GM/day from all acetaminophen products. • Check first for any previous administration and start 6 hours later if given.
Analgesia Orders: AS NEEDED	
Mild Pain (Pain Scale 1–3)	• Tylenol 650 mg PO every 4 hours (AS NEEDED) – NOT TO BE ORDERED IF PATIENT IS ON ATC ACETAMINOPHEN • Administration instructions: Do not exceed 4 GM/day from all acetaminophen products. Give if patient tolerating orals.
Moderate Pain (Pain Scale 4–6)	• Dilaudid (Hydromorphone) 2 mg PO every 4 hours (AS NEEDED) • Roxicodone (Oxycodone) 5 mg PO every 6 hours (AS NEEDED) • Effective upon arrival to floor. Do not give if patient has an active PCA/PCEA or continuous epidural infusion.
Severe Pain (Pain Scale 7–10)	• Dilaudid (Hydromorphone) 4 mg PO every 6 hours (AS NEEDED) • Roxicodone (Oxycodone) 5 mg PO every 4 hours (AS NEEDED) • Effective upon arrival to floor. Do not give if patient has an active PCA/PCEA or continuous epidural infusion.

ATC = around-the-clock; IV = intravenous; PCA = patient-controlled analgesia; PCEA = patient-controlled epidural analgesia; PO = orally; prn = as needed.

Note. Ketorolac (Toradol) and Ibuprofen (Motrin) around the clock is recommended for cesarean section without complications. Acetaminophen around the clock may be used concurrently with NSAIDs around the clock for eligible patients.

Kaiser Permanente Medical Center Order Sets

Sample

Participant sample criteria for this project included term postoperative cesarean birth patients ≥ 37 weeks of gestation, who received spinal or epidural anesthesia, who were 18 years or older, who gave birth to a singleton new-

born, admitted to the maternal child health department, and were prescribed opioids as a postoperative pain management treatment plan. Both planned and unplanned cesarean births were included. Vaginal births were excluded because typically, they are not prescribed opioids to

TABLE 2. MATERNAL DEMOGRAPHICS AND OBSTETRIC VARIABLES

Variable	Pre- and Postgroup		P values
	Pre (n = 75)	Post (n = 75)	
Ethnicity—Race			.22
Latino	35 (46.67%)	40 (53.33%)	
White	21 (28.00%)	15 (20.00%)	
Filipino	1 (1.33%)	7 (9.33%)	
Black	8 (10.67%)	7 (9.33%)	
Asian	2 (2.67%)	2 (2.67%)	
American Indian	1 (1.33%)	0 (0.00%)	
Chinese	3 (4.00%)	0 (0.00%)	
Asian Indian	3 (4.00%)	3 (4.00%)	
Vietnamese	1 (1.33%)	0 (0.00%)	
Arab	0 (0.00%)	1 (1.33%)	
Parity			.51
Primipara	38 (50.67%)	42 (56.00%)	
Multipara	37 (49.33%)	12 (16.00%)	
Cesarean Birth Type			.74
Primary	48 (64.00%)	46 (61.33%)	
Repeat	27 (36.00%)	29 (38.67%)	
Anesthesia Type			.87
Epidural	30 (40.00%)	31 (41.33%)	
Spinal	45 (60.00%)	44 (58.67%)	

Note. Due to rounding error, percentages may not sum to 100%.

treat postpartum pain. Other excluded conditions are patients who had chorioamnionitis, general anesthesia, intensive care unit transfers, opioid or nonsteroidal anti-inflammatory drug (NSAID) allergies, postpartum hemorrhage, positive urine toxicology, and preterm birth (< 37 weeks), as these factors may affect their pain scores.

Data

Data were collected from the electronic medical records (EMR) to review the total milligram of opioids and analgesics administered each 24 hours during the postoperative postpartum hospital stay. The opioid oral morphine milligram equivalent (MME) conversion factors were used to calculate the opioid dosages, Hydrocodone mg = 1 MME, Oxycodone mg = 1.5 MME (CDC, 2016).

Procedure

The process began with reviewing the pain management policy and medication order-set for treating the postoperative cesarean patient before and after a practice change. Before the practice change, predefined bundles of physician orders with standardized options included hydrocodone or oxycodone and decoupled (acetaminophen and oxycodone). After the practice change, acetaminophen and ibuprofen were administered around the clock

concurrently for patients who were eligible. Opioids were administered as breakthrough medication for moderate pain (scale 4–6) and severe pain (scale 7–10). Most of the physicians elected to use decoupled combinations so that patients could maximize their acetaminophen dose before adding an opioid. Data from the EMR on medication and dosages administered for pain were extracted and transferred to an excel spreadsheet for analysis.

With the policy change, the nurses became proactive in providing the necessary patient education before surgery, in the clinic, pre-op, reinforced on admission to labor and delivery, and during the postpartum recovery to reinforce the importance of managing pain. Nurses were attentive to the patients' pain care needs by maintaining a pain management regimen to manage their comfort level. Early ambulation in the first 8 to 12 hours was initiated to enhance recovery with the scheduled analgesics as an alternative method to promote mobility and comfort. Early nutrition was started with a snack in recovery to stimulate the gut postoperatively to decrease the risk of an ileus.

Analysis

Intellectus Statistics software was used to input, store, and analyze the data. Descriptive analyses were used to determine the mean and standard deviation of milligram equivalents of morphine administered before and after the change in practice. A *t*-test was used to determine whether there was a significant difference in the milligram equivalents of morphine administered between the pre- and postgroups. The opioid oral MME conversion factors were used to calculate the total milligram of opioids administered during the postoperative cesarean postpartum stay and then compared to determine if fewer dosages of opioids were administered to the pre- and postgroup. Levene's test was conducted to assess whether the two groups' total opioid oral (MME) variance was equal. A two-tailed Mann-Whitney two-sample rank-sum test was conducted to examine if there were significant differences in the total nonopioids administered between the pre- and postgroups.

A power analysis was conducted using G*Power, version 3.1, to determine the sample size using an α -level of .05, power of .80, and a moderate effect size estimate of 0.5. The estimated sample size was 64 patient records per group, and this was increased to 75 per group to compensate for records with potentially missing data.

Results

There were 150 patients included. Participants were divided into two groups: 75 pre- and 75 postpractice change. Maternal demographics, obstetrics variables, frequencies, and percentages are presented in Table 2. The highest sample percentages included primiparous Latino women ($n = 75$, 50.0%), a primary cesarean birth ($n = 94$, 62.6%), and spinal anesthesia ($n = 89$, 59.3%). Mean age of participants was $30.8 \pm$ years (pre, $SD = 5.23$; post, $SD = 4.69$) and the mean gestational age was 39.3 weeks (pre, $SD = 1.09$; post, $SD = 1.06$). See Table 3.

Despite the evidence supporting a multimodal plan of care to treat pain, implementation is inconsistent in the maternity inpatient setting.

The result of Levene's test was significant based on an alpha value of .05, $F(1, 148) = 12.40$, $p < .001$, suggesting that it was unlikely that the variance is equal for each category of the pre- and postgroup. The two-tailed independent samples t -test result for the total opioid oral (MME) administered was also significant ($p < .001$), shown in Table 4. This value suggests that the total opioid oral (MME) mean findings were significantly different between the two groups. The mean total shows that fewer milligram equivalents of morphine were administered to the postgroup. The total opioid oral (MME) decreased from 27.1 to 8.4 after the practice change (Figure 1).

The p -value for the total nonopioids administered varied between the two groups (Table 3). A comparison of the nonopioid milligram mean value is presented in Figure 2. Results suggest a significant difference in the distribution of nonopioids between the two groups. The mean milligram for Motrin PO administered was more for the pregroup (2,256 mg) compared with the postgroup (1,258 mg), with a difference of ($d = 0.70$). Before the practice change, Motrin PO was administered as a scheduled pain management medication.

Discussion

After the practice change, the mean total of the opioid oral MME was significantly different between the pre- and postgroup. Fewer opioids were administered to the postgroup, with increased nonopioids administered to treat postoperative cesarean postpartum pain. In a comparable study (Hedderson et al., 2019), an evaluation of the implementation of an enhanced recovery after surgery (ERAS) program for elective cesarean birth at Kaiser Permanente in Northern California had significant findings. The daily inpatient morphine equivalents decreased from 10.7 to 5.4 with increased use of multimodal analgesia from 9.7% to 88.8%, reporting acceptable pain scores significantly higher from 82.1% to 86.4% ($P < .001$) after the ERAS program was implemented (Hedderson et al., 2019).

Limiting opioid exposure is the best and safest practice for the mother and newborn to promote optimal health, safety, and well-being. Enhanced recovery after surgery guidelines have improved the quality of care, patient safety, and health care outcomes, providing best practice for optimizing postoperative postpartum care (Macones et al., 2019). The goal is to decrease the overall need for opioids to reduce the risk of dependency among postpartum women.

The pandemic was one of the catalysts for implementing a pain management practice change in the ma-

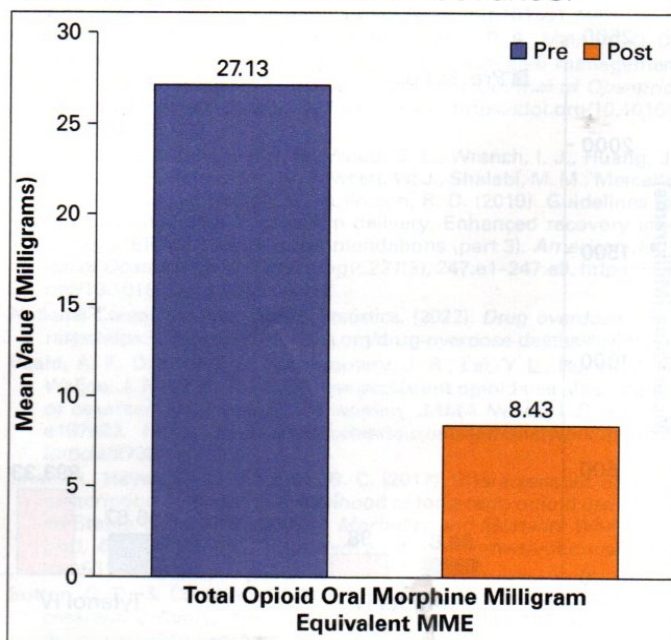
TABLE 3. MATERNAL AND GESTATIONAL AGE BY GROUP

Variable	M	SD	Min	Max	<i>p</i> Values
Maternal Age					.46
Pre	30.51	5.23	19.00	44.00	
Post	31.11	4.69	18.00	43.00	
Gestational Age					.51
Pre	39.37	1.09	37.10	41.50	
Post	39.25	1.06	37.00	41.40	

ternal child health department at Kaiser Permanente in Southern California. Results have shown that it is possible to manage postoperative cesarean birth pain using a multimodal plan of care that does not include opioids routinely as the first-line treatment for pain. Rather, NSAIDs and Tylenol can be given first with opioids for breakthrough pain medication (Hedderson et al., 2019).

A limitation of this study was that we did not have an opportunity to interview the patients about their pain management care experience because this was a retrospective medical record review. Although the initial pain score before medicating each group was documented on the EMR, the opportunities for documentation of the reassessment of pain scores within defined limits were noted. Thus, we could not compare pain assessment scores before and after the implementation of the protocol.

FIGURE 1. THE MEAN OF TOTAL OPIOID ADMINISTERED BY PRE- AND POSTGROUP



Clinical Implications

Our study found fewer milligram equivalents of morphine were administered when postoperative cesarean patients were placed on scheduled nonopioids to treat pain. Nurse and patient education can help increase knowledge to facilitate awareness and understanding of a multimodal treatment plan. Improving pain management is necessary, and a multimodal plan of care to manage postoperative postpartum pain can be an alternative way

to effectively reduce the risk of opioid use, dependency, and addiction.

Therefore, a multimodal pain management treatment plan that provides NSAIDs and acetaminophen first, then around the clock with opioids reserved for breakthrough pain should be standardized in obstetrical care. Nurses must be proactive in providing patient education before surgery and implementation of the treatment plan while reinforcing the importance of pain

TABLE 4. DIFFERENCES IN OPIOID AND NONOPIOIDS ADMINISTERED BEFORE AND AFTER THE PRACTICE CHANGE

Two-Tailed Independent Samples <i>t</i> -Test for Total Opioid Oral Morphine Milligram Equivalent MME by Pre- and Postgroup							
Variable	Pre		Post		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Total Opioid Oral Morphine Milligram Equivalent MME	27.13	20.77	8.43	14.27	6.43	<.001	1.05

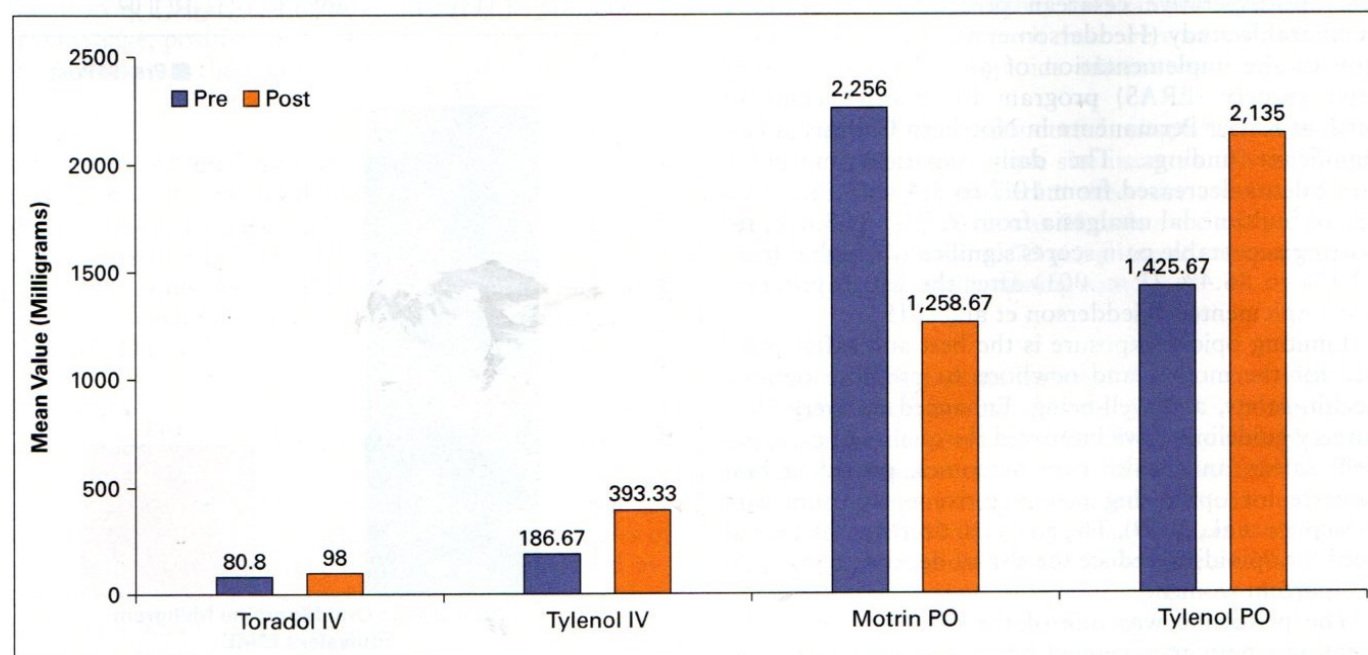
Note. *N* = 150. Degrees of Freedom for the *t*-statistic = 131.13. *d* represents Cohen's *d*.

Two-Tailed Independent Samples <i>t</i> -Test for Total Nonopioid Milligram Administered by Pre- and Postgroup							
Variable	Pre		Post		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Toradol IV Total Mg Administered	80.80	56.23	98.00	53.88	-1.91	.058	0.31
Tylenol IV Total Mg Administered	186.67	691.52	393.33	712.07	-1.80	.073	0.29
Motrin PO Total Mg Administered	2,256.00	1,574.99	1,258.67	1,248.90	4.30	<.001	0.70
Tylenol PO Total Mg Administered	1,425.67	943.59	2,135.00	1,658.14	-3.22	.002	0.53

Note. *N* = 150. Degrees of Freedom for the *t*-statistic = 148. *d* represents Cohen's *d*.

MME = Morphine Milligram Equivalent.

FIGURE 2. THE MEAN OF TOTAL NONOPIOID ADMINISTERED BY PRE- AND POSTGROUP



CLINICAL IMPLICATIONS

- A multimodal pain management treatment plan that provides NSAIDs and acetaminophen first, then around the clock with opioids reserved for breakthrough pain should be standardized in obstetrical care.
- A multimodal plan of care can be an alternative way to effectively reduce the risk of opioid use, dependency, and addiction.
- The literature has shown the positive benefits of a multimodal approach for postpartum pain management.
- Limiting opioid exposure can promote optimal health, safety, and well-being for the mother and newborn.
- Nurses should be proactive in providing patient education before surgery and implementation of the treatment plan while reinforcing the importance of pain management.
- Nurses need to provide and promote alternative comfort measures, such as wearing an abdominal binder for abdominal support and deep breathing relaxation exercises, along with early ambulation and early nutrition.
- Nurses need to reassess pain to determine the effectiveness of a pain management regimen.
- Nurses must ensure that the patient's comfort level is well managed and maintained.

management. Nurses must be diligent and attentive to their patients' pain care needs while providing and promoting alternative comfort measures, such as wearing an abdominal binder for abdominal support and deep breathing relaxation exercises. Pain reassessment is necessary each time the patient is medicated to determine the effectiveness of a pain management regimen. Nurses should ensure that the patient's comfort level is well managed and maintained. ❖

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