A Comparison of the Traditional Method of Oral PRN Pain Medication Delivery to an Electronic Oral Patient Controlled Analgesia (PCA) Device Following Total Knee Arthroplasty (TKA)

Additional Statistical Analysis of Data:

Table 3
Percentage of Pain Score Distribution ≥ 5

Worst reported pain within the last 24-hours prior to discharge
Based on a chi-square analysis comparing the two groups, the data is statistically different (p=0.04)* with the Usual Care Group having a higher percentage of pain scores ≥ 5 as compared to the Device Group (86.7% vs. 63.3%).

Day #2 Post-Op Pain Scores
Based on a chi-square analysis comparing the two groups, the data is statistically different (p=0.0007) with the Usual Care Group having a higher percentage of pain scores ≥ 5 as compared to the Device Group (74.6% vs. 55.2%).

Table 5 & Figure 1
Percentage of Interference from Pain During the Hospital Stay
A chi-square analysis was run to compare the percentage of scores ≥ 5 between groups looking across all five measures: pain interference from General Activity, Mood, Physical Therapy, Sleep, and Appetite. For the entire group, the differences were significant (p=0.02) with the Usual Care Group having 44.7% of observations >=5 compared to the Device Group with 31.5%. Chi-square analysis comparing the Device Groups started on post-op day #1 versus day #2 did not meet statistical significance likely due to the smaller sample sizes involved in these analyses.

*p values ≤ 0.05 are considered statistically significant

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Abstract

As-needed (PRN) oral pain medication is an essential part of multimodal pain therapy. Medication delivery is often delayed because of multiple demands upon nursing time in a busy postoperative nursing unit. Postoperative pain control was compared using either the manual delivery of PRN oral pain medication or a bedside oral patient-controlled analgesia device. Thirty patients in each group completed a survey on the day of discharge, and additional data were collected by chart reviews. Device patients had significantly better pain scores than the usual care group on postoperative Day 2 and within the last 24 hours prior to discharge. The device group reported statistically less pain interference overall with general activity, mood, physical therapy, sleep, and appetite. Use of an oral patient-controlled analgesia device may improve pain management and patient function following total knee arthroplasty compared to the traditional delivery of oral PRN pain medication.

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Abstract

Purpose: To determine if differences in patient reported pain management effectiveness and patient outcomes could be measured comparing two methods of PRN oral pain medication delivery in an orthopedic surgery inpatient unit.

Objective #1: To track patient length of stay and reported pain scores for these two approaches.

Objective #2: To gather and compare patient feedback from a patient questionnaire regarding pain interference with recovery parameters using these two methods.

Background/Problem: Orthopedic surgery requires multimodality pain management to achieve adequate analgesia following joint replacement surgery. Requested PRN oral pain medication delivery is often delayed due to the ongoing multiple demands upon nursing time in a busy orthopedic post-operative unit. The problem generated by delayed pain medication delivery results in poor patient satisfaction with pain management and an impact on overall patient recovery indicators. A possible solution could be the adoption of technology to respond on time to the patient request for PRN oral medication and to assist in the time consuming task of the manual delivery of every dose of oral pain medication. This pilot research study was designed to discover if a better way for PRN oral pain medication delivery was available.

Methodology/Sample: This is a quantitative comparative study of 60 inpatients enrolled following informed consent in an IRB-approved pain management study. One group was managed with usual care, meaning nursing staff delivery of PRN oral pain medications (N=30), whereas the second group received their oral pain medications from the electronic PCA device (N=30). All patients received the same multimodality pain management, including femoral nerve blocks, with the exception of the mode of delivery of oral PRN pain medications (Table 1). Patient questionnaires were completed the day of discharge and additional data was collected from chart reviews.

Results: There were no significant differences between the age distributions and length of stay although there was no attempt to match sex/age between the two groups studied. Both groups reported no statistical differences in acceptable pain scores at the time of admission i.e. 3.17 ± 0.91 and 3.23 ± 0.77 (Table 2). The usual care group had a larger percentage of pain scores ≥ 5 at 75% as compared to the device group at 55% on post-op day #2. On the day of discharge 63% of the device group reported the worst pain experienced within the last 24hrs ≥ 5 as compared to 87% in the usual care group (Table 3). No significant differences could be found between the dosages of IV pain PRN rescue opioids used for both groups. Patient questionnaires were completed the day of discharge. The device group reported a reduction in interference from pain with general activity, mood, physical therapy, sleep, and appetite as compared to the usual care group during their hospital stay (Table 5/Figure 1).

Limitations: Limitations of the study included the limited study size, no prospective randomization of patients, and some minor variations in the duration of the femoral nerve block among patients (Table 4).

Conclusions: By post-op day #2, device group patients reported a 20% reduction in pain scores ≥ 5 compared to the usual care group, whereas there was a 24% reduction in the worst pain scores in the device group within 24 hours of discharge. Device group patients reported less interference from pain in all outcome parameters as compared to the usual care group. Patient pain scores from both groups were too high as compared with the average score of 3.2 that patients reported as ideal for them during the hospital stay.

Implications: The adoption of technology in the form of an electronic oral PCA device may improve pain management and patient recovery indicators as part of multimodality pain management in orthopedic post-op units. Changes in the multimodal pain management regimen are underway to continue to improve and achieve acceptable patient pain scores.

Table 1. Multimodal Regimen for Pain Management for TKA

Preoperative Analgesia in the Surgical Holding Area Femoral catheter placed for regional nerve block
Intraoperative Anesthesia and Analgesia General anesthesia
Post-Operative Anesthesia (Post-Anesthesia Care Unit - PACU) Continuous femoral peripheral nerve catheter with ropivacaine 0.2% in 0.9% saline (2mg/ml) at a continuous infusion rate of 4ml/hour (8mg/hr) with a PCA dose of 4ml with a 15-minute lockout. Other intravenous opioids as need for pain control per anesthesia.
Post-Operative Analgesia (Inpatient Care Unit) Within the first 8 hrs after transfer to the inpatient nursing unit, a one-time bolus by nursing from the nerve block infusion pump of 10ml (20mg) for a numeric pain score ≥ 5 and an increase in the infusion rate to 6ml/hr (12mg) with a dose escalation for breakthrough pain by numeric pain score by physician orders not to exceed 10ml/hr (20mg/hr). The continuous peripheral nerve catheter is discontinued at the anesthesia physician's discretion on either post-op day 1 or day 2.
Multimodal Non-Opioid Regimen Ketorolac 15 mg every 6 hours IV x 4 doses then every 6hrs PRN pain Pregabalin 50 mg oral BID x 3 days Celecoxib 400mg po x 1 then 200mg po BID
IV Rescue Opioid Analgesic Hydromorphone 0.5 or 1 mg every 2 hrs PRN pain
Device Patients – Group 1 – Oral Analgesic Oxycodone/acetaminophen 5mg/325mg or hydrocodone/acetaminophen 7.5mg/325mg with first dose now and q 3 hours PRN or 4 hrs PRN per the device orders. The nurse was able to administer a "now" single dose directly from the device on call to physical therapy or for pain not relieved after a minimum time of 1 hour from self-administration of the oral pain medication up to 3 times within a 24-hour period.
Usual Care – Group 2 - Oral Analgesic Oxycodone/acetaminophen (5mg/325mg) 1-2 tabs every 4 hours PRN pain or hydrocodone/acetaminophen (7.5mg/325mg) 1-2 tabs every 4 hours PRN pain

Table 2. Patient Demographic and Pain Summary

	Sex	Age, Years ± SD	Length of Stay (hrs)	Tolerable Pain Score ± SD
Device Group N=30	M (16) 53% F (14) 47%	63.7 ± 9.3	*Median 71 LQ 68 UQ 76 IQR 8 All ≥ 88 hrs outliers	3.17 ± 0.91
Usual Care Group N=30	M (11) 37% F (19) 63%	64.7 ± 9.6	Median 72 LQ 70, UQ 74 IQR 4 All ≥ 80hrs are outliers	3.23 ± 0.77

*Using interquartile ranges (IQR) the median LOS is reported in hours, (LQ) lower quartile, (UQ) upper quartile.

Table 3. Patient Pain Scores at the Time of Medication Administration

Groups Each N=30 Patients	Number of Doses (tabs) of Oral PRN Pain Meds Delivered Oxycodone/ Acetaminophen – (Percocet - P); Hydrocodone/ Acetaminophen – (Lortab - L)		IV Rescue Meds in mg for Pain Hydromorphone (Dilaudid - D) or Ketorolac – (Toradol - T)		Percentage Pain Score Distribution ≥ 5	
					Day #2	Worst reported pain within last 24 hrs prior to discharge
Post-op Day	Day 1	Day 2	Day 1	Day 2		
Device Group	P 148 L 27	P 121 L 19	D 55 T 285	D 57 T 210	55%	63%
Usual Care	P 90 L 23	P 117 L 21	D 33 T 405	D 21 T 390	75%	87%

Table 4. Percentages of Patients Using All Pain Modalities

	Femoral Nerve Block			Intravenous Rescue PRN Opioids			Oral PRN Opioids		
Post-Op Day	1	2	3	1	2	3	1	2	3
Device Group N=30	97	27	4	60	43	28	100	97	96
Usual Care Group N=30	90	21	14	70	48	19	83	90	95

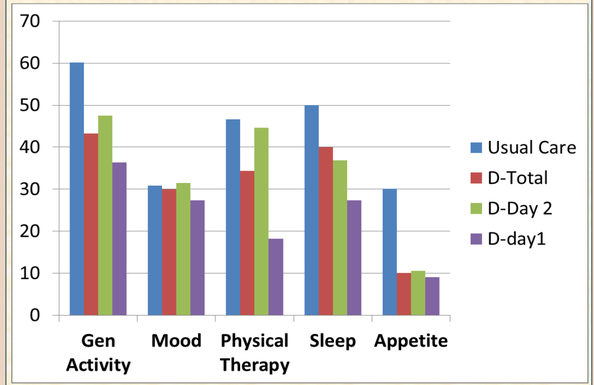
Table 5. Percentage of Patients Reporting Pain Interference Relating to Outcome Measures

Interference recorded on a scale of 0-10 with 10 being maximum interference percentages reported are those patients who reported interference ≥ 5

Group	General Activity	Mood	Physical Therapy	Sleep	Appetite
Device Group N=30	43%	30%	34%	40%	10%
Device Group N=11 Started MOD day #1	36%	27%	18%	27%	9%
MOD N=19 Started Day #2	48%	32%	45%	37%	11%
Usual Care Group N=30	60%	31%	47%	50%	30%

Figure 1. Percentage of Interference from Pain

Percentage of interference from pain on outcome parameters where interference is measured on a scale of 0 to 10 with 10 being maximum interference. Data shown is percentages reporting interference ≥ 5.



D-Total percentages of all patients using devices N=30
D- Day #2 – patients starting devices Post-op Day +2 until discharge N=19
D- Day #1 – patients starting devices Post-op Day +1 until discharge N=11