

# Combination of Demand Only PCA and Short Term Methadone to Decrease Length of Stay in Sickle Cell Disease Vaso-occlusive Acute Pain

Dustin Liebling, MD<sup>1</sup>; Jaeun Choi, Ph.D.<sup>2</sup>; Qi Gao, Ph.D.<sup>2</sup>; Karen Moody, MD, MS<sup>3</sup>; Deepa Manwani, MD<sup>4,5</sup>; Veronica Carullo, MD<sup>1,4,5</sup>

<sup>1</sup>Department of Anesthesiology, Montefiore Medical Center, Bronx, NY; <sup>2</sup>Department of Epidemiology and Population Health, Albert Einstein College of Medicine, Bronx, NY; <sup>3</sup>Department of Pediatrics, MD Anderson Cancer Center, Houston, TX; <sup>4</sup>Department of Pediatrics, Children's Hospital at Montefiore, Bronx, NY; <sup>5</sup>Albert Einstein College of Medicine, Bronx, NY;

## Introduction

Sickle cell disease (SCD) is a genetic disorder characterized by chronic and unpredictable episodes of pain, cumulative organ damage, and high healthcare utilization rates. Vaso-occlusive pain crisis (VOC) is the most frequent cause of hospital admissions in patients with SCD, accounting for over 110,000 hospitalizations annually. Intravenous opioids are considered a mainstay in the management of VOC. In 2007, van Beers and colleagues demonstrated that the use of patient-controlled analgesia (PCA) results in significant reductions in morphine consumption with equivalent response on measurements of pain and quality of life; this is largely accepted by SCD providers. There remains controversy regarding the method of administration of opioids. PCA with basal infusion plus demand dosing is preferred by the hematology community, whereas emerging data in other populations demonstrate adequate pain control and reduced rates of opioid-related adverse events with the use of demand-only approaches. In October 2012, as part of a quality improvement initiative at the Children's Hospital at Montefiore, we revised our pain management guidelines to exclude the routine use of basal infusions in our PCA protocol. In addition, pain management consultation was requested to assist in management of PCA, particularly as it related to the appropriate use of basal infusions when indicated and timely transition to oral analgesics. Short-term methadone during the inpatient stay with a short taper post-discharge was utilized for improved and long-acting analgesia in patients that did not improve rapidly on the standard regimen.

## Methods

A retrospective analysis of patients with SCD less than 21 years of age who were admitted for VOC 3-7 times/year was completed, comparing patient admissions in 2011 versus 2013, pre- and post-revision of the pain protocol as described above. Baseline variables evaluated include demographic and clinical characteristics outlined in Table 1. Primary outcomes include total opioid utilization during inpatient admission, total hours on intravenous PCA and length of stay (LOS). Secondary outcomes include rates of acute chest syndrome, hypoxia, exchange transfusion and transfer to the pediatric intensive care unit.

The authors have no relevant conflicts of interest to disclose.

- A total of 144 admissions were included in the analysis.
- Baseline demographics and clinical characteristics were similar in both groups.

**Table 1. Baseline demographic and clinical characteristics by admissions**

	2011 (n=73)	2013 (n=72)	P-value
Age (years)	16.3 ± 3.5	15.4 ± 3.3	0.40
Gender			0.62
M	39 (53.4%)	32 (44.4%)	
F	34 (46.6%)	40 (55.6%)	
Race			0.87
Black	60 (82.2%)	61 (84.7%)	
Multiracial	13 (17.8%)	11 (15.3%)	
Ethnicity			0.85
Non-Hispanic	55 (75.3%)	55 (76.4%)	
Hispanic	18 (24.7%)	17 (23.6%)	
Genotype			0.18
Hgb SS	68 (93.2%)	59 (81.9%)	
Hgb SC	5 (6.8%)	13 (18.1%)	
Weight (kg)	57.3 ± 17.6	54.7 ± 19.3	0.45
Opioid tolerant			0.25
Y	9 (12.3%)	3 (4.2%)	
N	64 (87.7%)	69 (95.8%)	
Hydroxyurea			0.50
Y	44 (60.3%)	33 (45.8%)	
N	29 (39.7%)	39 (54.2%)	
Hemoglobin (g/dL)	8.7 ± 1.8	8.6 ± 1.6	0.85
HgbS %	77.5 ± 10.4	77.7 ± 15.1	0.97
HgbF %	10.9 ± 6.9	6.5 ± 5.6	0.10

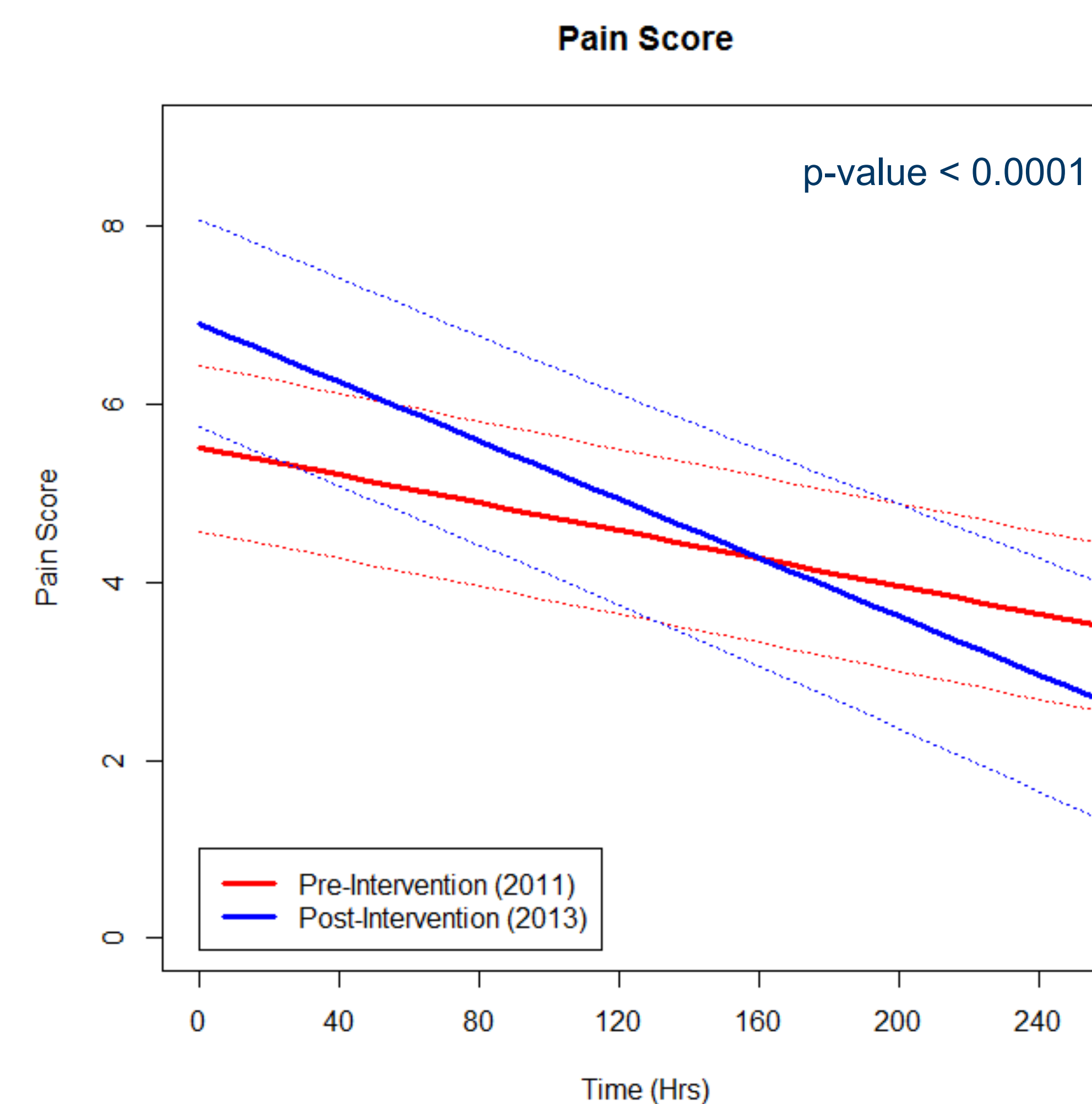
- In 2011, 72/73 patient admissions were treated with PCA with basal infusion compared to only 1/72 patients in 2013.
- In 2011, 7/73 patient admissions (2 unique patients) received Methadone compared to 9/72 patient admissions (4 unique patients) in 2013.
- In 2011, median daily methadone dose was 20 mg started on D0 of admission with the plan to continue methadone as a mode of chronic pain management.
- In 2013, median daily methadone dose was 5 mg, started on D1 of admission and weaned in 4-20 days post-discharge.

**Table 2: Comparison of outcomes by admissions**

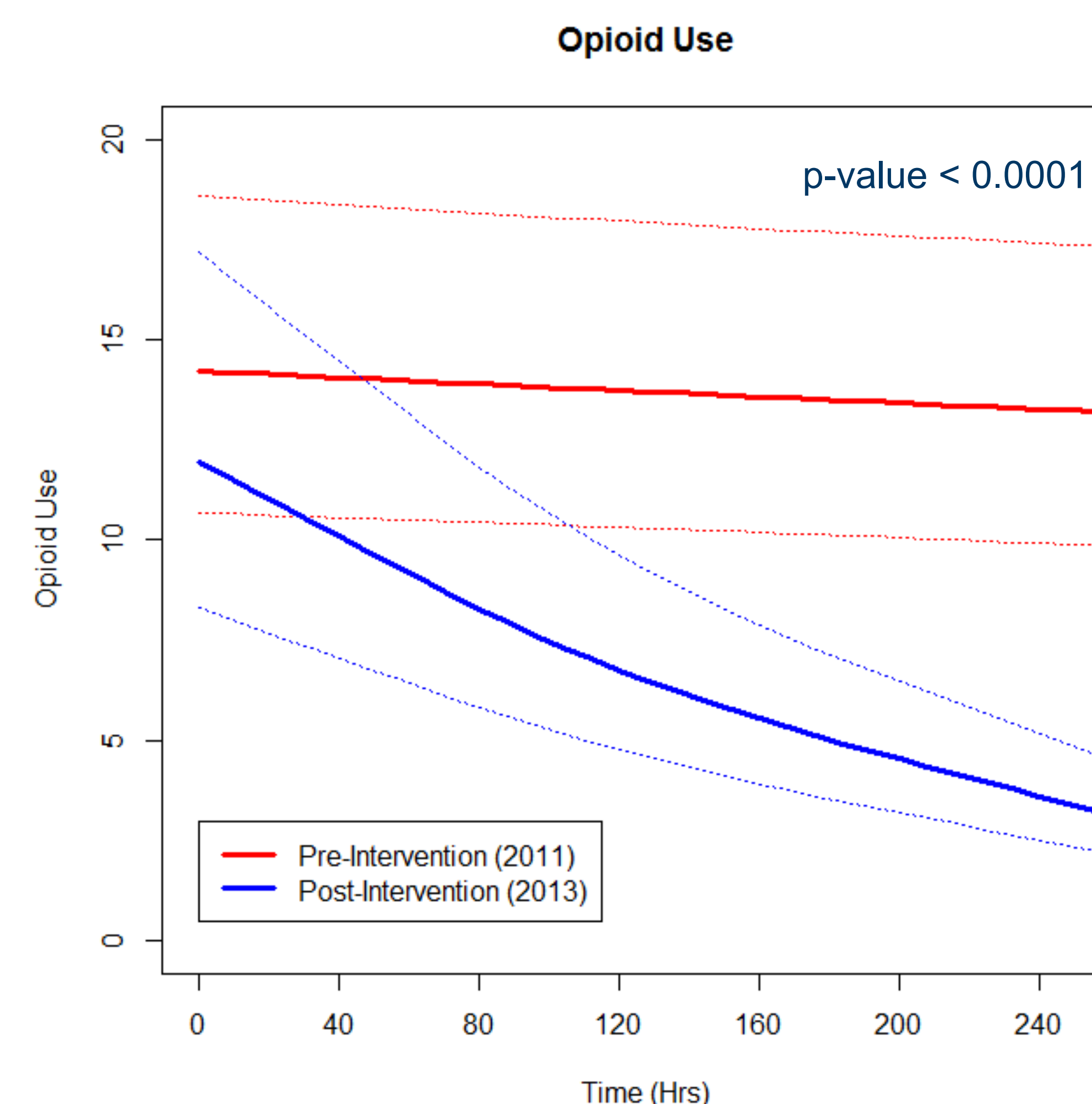
	2011 (n=73)	2013 (n=72)	P-value
Total opioid utilization during inpatient admission (mg IV ME/kg)	13.3 ± 33.8	3.6 ± 3.0	0.0003
Hydromorphone IV PCA	16/73 (22%)	27/72 (37%)	0.44
Total PCA hours	153.2 ± 103.2	80.0 ± 45.4	<0.0001
Day of first oral opioid	4.6 ± 3.5	3.4 ± 1.9	0.0105
Length of VOC (days)	7.2 ± 5.1	4.5 ± 3.8	<0.0001
Length of stay (days)	7.5 ± 5.0	5.5 ± 7.4	0.002
ER pain score	8.6 ± 1.3	8.9 ± 1.2	0.47
Admit pain score	8.0 ± 1.3	8.1 ± 1.5	0.78
Change in pain score (Admit to discharge)	5.5 ± 3.1	5.7 ± 3.2	0.82
Hypoxia	21/73 (28.8%)	5/72 (6.9%)	0.0008
Acute chest syndrome	16/73 (21.9%)	2/72 (2.8%)	0.0043
30-day readmission	29/73 (39.7%)	23/72 (31.9%)	0.31
ER visit post-discharge	5/73 (6.8%)	7/72 (9.7%)	0.79
PICU admissions	3/73 (4.1%)	1/72 (1.4%)	0.133
Exchange transfusions	2/73 (2.7%)	1/72 (1.4%)	0.167

## Results

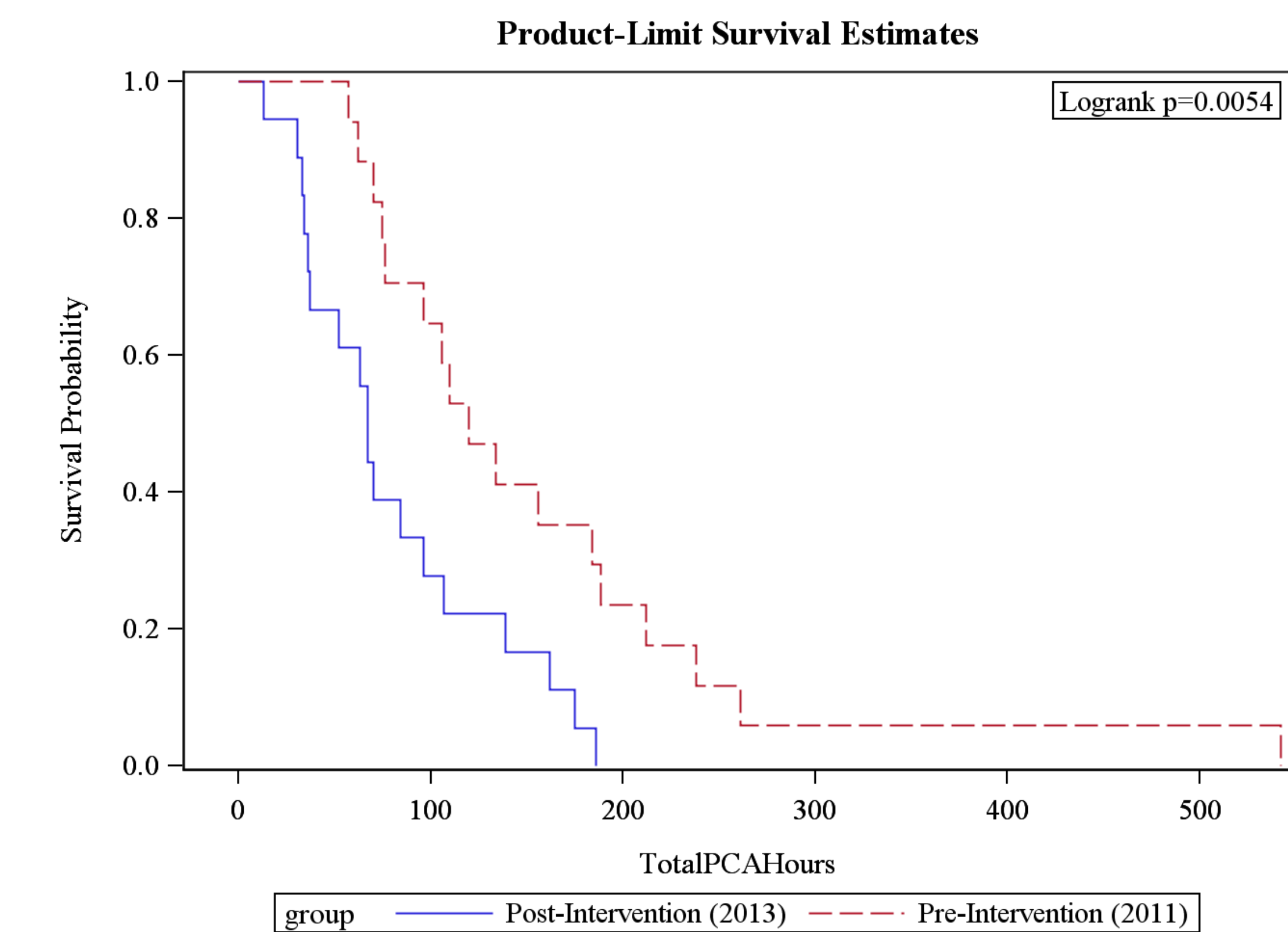
**Figure 1. Pain score over time**



**Figure 2. Opioid use over time**



**Figure 3. K-M curves for total PCA hours by intervention group**



## Conclusions

- We demonstrated the feasibility of demand-only PCA in the successful management of vaso-occlusive crisis pain when compared to PCA with basal infusion.
- The patients treated with the demand-only PCA utilized less opioids, had decreased number of hours on PCA, a decreased LOS with decreased episodes of hypoxia and acute chest syndrome.
- In the small number of patients who experience intractable pain unresponsive to IV PCA, methadone can provide acute pain control.
- Superiority of the demand-only PCA approach needs to be further evaluated in a randomized prospective study enabling a direct and more definitive comparison of the two approaches.

## References

- Shah N, Rollins M, Landi D, Radhika S, Bae J, De Castro L. Differences in Pain Management Between Hematologists and Hospitalists Caring for Patients With Sickle Cell Disease Hospitalized for Vasoocclusive Crisis. Clin J Pain 2014; 30:266-26.
- van Beers EJ, van Tuijn CF, Nieuwkerk PT, Friedrich PW, Vranken JH, Biemond BJ. Patient-controlled analgesia versus continuous infusion of morphine during vaso-occlusive crisis in sickle cell disease, a randomized controlled trial. Am J Hematol 2007 Nov;82(11):955-60.