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Reducing Opioid Induced Respiratory Depression in Post-Operative Arthroplasty Patients

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Abstract

Pain management in post-operative hospitalized patients often involves the use of opioids and other potential sedating medications. However, with an aging population accompanied by increasing co-morbidities, there is growing concern for opioid induced respiratory depression (OIRD). Despite this growing concern, there has not been an evidence-based method to identify patients at risk for OIRD, nor ways to allocate monitoring modalities appropriately. Our aim is to compare two clinical tools on their efficacy in predicting opioid induced respiratory depression (OIRD), as well as to determine whether our remote monitoring strategy reduces naloxone usage

We reviewed retrospective data from our own health system on naloxone use and based on these findings we modified the Opioid Predictive Risk Assessment Tool (OPRAT) into the HFHS OPRAT which we hypothesize is more predictive of patients at risk for OIRD than the Michigan Opioid Safety Score (MOSS) in use previously.

Post-operative arthroplasty patients admitted to Henry Ford Main Hospital in January - December 2019 will each be assigned a MOSS and a HFHS OPRAT score. Data will be reviewed retrospectively to determine which score is more predictive of OIRD. Patients receiving HFHS OPRAT more than 10 and requiring supplemental oxygen are considered high risk, therefore they would be subjective to continuous pulse oximetry with either acoustic respiratory rate monitor or end-tidal carbon dioxide monitor. This cohort of patient in 2019 will be compared with a historical cohort in 2017 (before the introduction of remote acoustic respiratory rate monitoring) to evaluate if the current monitoring modality reduces naloxone usage.

Hypothesis

- Implement a remote monitoring system for detection of opioid-induced respiratory depression (OIRD) in hospitalized patients
- Determine if a remote monitoring system implementation reduced the need for emergency reversal of OIRD with naloxone
- Evaluate and validate two different clinical tools to identify patients at high risk for OIRD

Introduction

- In hospitalized patients, OIRD is cited as a major cause of preventable adverse events
- There is lack of consensus on how to identify patients at risk and which monitoring modalities are most effective at reducing this risk
- Several tools have been suggested for identification of patients at high risk of developing OIRD, including Michigan Opioid Safety Score (MOSS) and Opioid Predictive Risk Assessment Tool (OPRAT), PRODIGY score
- Based on our own HFHS data as well as literature review, we modified the existing OPRAT into the HFHS OPRAT tool which we believe is more clinically applicable

Methods

- Masimo Safety Net system was implemented 10/2018 for post operative arthroplasty patients
- Retrospectively analyze data from total joint arthroplasty patients at HFH from January 1st, 2019 - December 31st, 2019
- Compare rates of naloxone usage on arthroplasty patients with remote monitoring in place to a historical cohort (2017)
- Compare MOSS scores and HFHS OPRAT scores to see which was more predictive of OIRD

MHA Keystone Center

Michigan Opioid Safety Score (MOSS)
Roy Soto, M.D.

RISK STRATIFICATION

MOSS= Health Risk (maximum of 2 points) + RR Score +/- mPOSS STOP modifier
(Possible score 0 – 4 with possible STOP modifier)

		Circle point score if any criteria apply to patient	MOSS Score (Total Points)
A) Health Risk			
Group 1	• OSA • Snoring • BMI>40	1	
Group 2	• Abd/Thor surgery • Anesthesia time >3hr (within 24hr of assessment)	1	
Group 3	• Concomitant sedatives received within 2 hours	1	
Group 4	• Age > 75 • Smoker	1	
If points total for this section is >2, enter "2" for MOSS Score here:			
B) Respiratory Rate			
Respiratory Rate ≥ 10		0	
Respiratory Rate < 10		2	
Add points from this section to MOSS Score above and enter here:			
C) Modified Pasero Opioid-Induced Sedation Scale (mPoss): STOP Modifier			
Excessively sedated, drifts off to sleep, difficult to arouse or unarousable		STOP	
If STOP is circled for this section, enter "STOP" for MOSS Score and follow guidelines below			

MOSS INTERPRETATION

STOP	STOP	Stop all opioids Notify primary physician Institute increased levels of monitoring Consider anesthesia/pain consultation Ensure multimodal analgesia delivered Consider reversal agents (naloxone or flumazanil as appropriate)
4	CAUTION	Decrease opioid dose Increase levels of monitoring
3		Ensure multimodal analgesia delivered
2	CONCERN	Increase opioids as needed with special attention Consider increased levels of monitoring Ensure multimodal analgesia delivered
1	SAFE	Safe to proceed with further opioid dosing Ensure multimodal analgesia delivered
0		

Figure 1: MOSS

HFHS Opioid Predictive Risk Assessment Tool

Risk Factor		Points
Age		
	60 – 70	2
	71 – 80	6
	>80	8
Concurrent sedating medications (including benzodiazepines, gabapentin, muscle relaxants, sleep aids)		4
PCA Use (containing opioid)		
	With continuous basal rate	10
	Without basal rate	4
Surgery or procedure within 24 hours		4
Obstructive Sleep Apnea (OSA)		4
BMI >= 30		2
COPD		2
Congestive heart failure		2
Renal impairment (GFR <60)		2
Duration of anesthesia > 3 hours		2
History of smoking		2
Total		

Figure 2: OPRAT

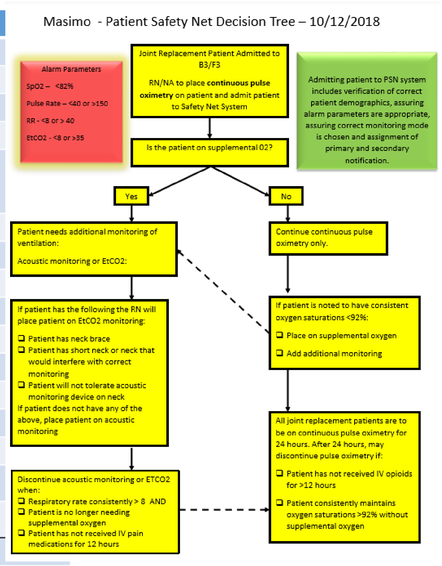

Figure 3: Masimo Safety Net Decision Tree

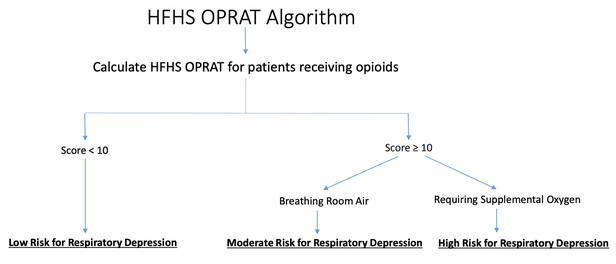

Figure 4: OPRAT Algorithm

Laboratory Values and Printing Tips

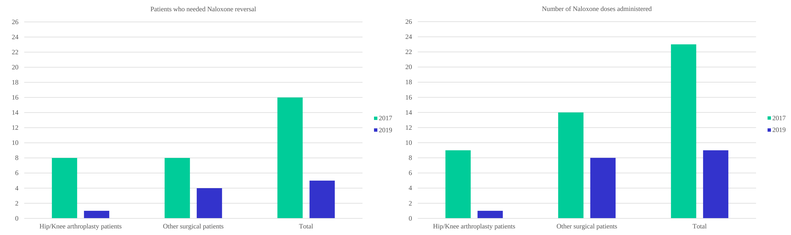

Figure 4: Comparing 2017 and 2019 naloxone administration

Predictor	AUC – Training	AUC – Test	OR (95% CI)	P-value
MOSS	0.964	0.723	0.97 (0.48, 2.12)	0.942
OPRAT	0.964	0.761	1.14 (1.05, 1.27)	0.004

Figure 5: Comparing 2017 and 2019 naloxone administration

Discussion

- The Joint Commission and Centers for Medicare and Medicaid Services have identified OIRD as a primary patient safety concern
- Currently, no validated tools exist to identify patients at risk of OIRD. Though there are ongoing studies on OIRD
- From looking at system-wide data on patients who received emergency reversal for OIRD, we were able to identify risk factors that predisposed these patients to life-threatening OIRD
- We then convened a group of physicians to develop a tool (HFHS OPRAT) that could be easily used to identify these high-risk patients
- Retrospective data analysis shows that the OPRAT has higher predictability of recognizing OIRD. Further data analysis is in progress which includes, but not limited to the frequency of OIRD, types of alerts captured during the admission and prior to naloxone administration
- Upon validation, further goal include using our tool to include other inpatient populations and make the tool a part of regular nursing assessments to improve patient safety

Conclusion

- Upon analysis of data from naloxone administration after implementation of the Masimo Safety Net System, it is evident that remote monitoring system can help with early detection of OIRD, and it can be effective in other inpatient areas and at other HFHS hospitals

Bibliography

1. Soto, R. et al. (2015) The Michigan Opioid Safety Score (MOSS): A Patient Safety and Nurse Empowerment Tool. Journal of PeriAnesthesia Nursing 30(3):196-200