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Multimodal Pain Control in Common Neonatal Surgeries: Post-operative Pain Protocol Reduces Opiate Exposure and Side Effects

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Multimodal Pain Control in Common Neonatal Surgeries: Post-Op Pain Protocol Reduces Opiate Exposure and Side Effects

Research Days Platform Presentation
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Disclosures

- No disclosures of conflicts of interest

Background

- Opioids are the primary post-op analgesic in neonates with side effects including hypotension, apnea and ileus
- Previous studies have shown that IV acetaminophen decreases opiate exposure
- The effect of IV acetaminophen as part of a post-op pain algorithm in neonates and infants is unknown

Multimodal Analgesia: *Alternatives to Opioids*

- Although opiates are the mainstay of postoperative pain treatment in the NICU, it is important to consider alternatives to opioid analgesics including nonpharmacologic options
- Use of non-opiate analgesics can decrease short- and long-term sequelae including excessive sedation and subsequent withdrawal
- “Perioperative acetaminophen amongst other drugs may decrease postoperative pain and opioid consumption in some pediatric surgical populations”¹

1 - Zhu Aet al, *Anesth Analg*, 2017

Objectives

- To determine if
 - (a) a post-op pain algorithm including IV acetaminophen reduces cumulative opioid requirements in neonates undergoing common surgeries in the NICU
 - (b) IV acetaminophen exposure reduces cumulative opioid requirements in neonates undergoing common surgeries in the NICU

Methods

- Retrospective cohort study comparing 72 hour post-operative opiate exposure between infants with common surgeries in the NICU
 - pre-pain algorithm (2013-2015) *versus* post-pain algorithm (2016-2018)
 - infants who receive post-op IV acetaminophen *versus* those who did not
- Chi-square, Fisher's Exact, Wilcoxon Rank Sum and t-tests were used for outcome comparisons between groups

Demographics of Comparative Cohorts

Cohorts defined by algorithm implementation			
	Pre-algorithm	Post-algorithm	p-value
N	306	384	
Gestational Age (wks), mean (sd)	34.58 (5.10)	34.28 (5.25)	0.446
Sex, n (%)			0.588
Male	180 (58.82)	218 (56.77)	
Female	126 (41.18)	166 (43.23)	
Birthweight, median (IQR)	2410 (1335-3110)	2462.5 (1415-3255)	0.829
Primary Surgery, n (%)			<0.001
G-Tube +/- fundus	128 (41.83)	173 (45.05)	
Colostomy/take down	72 (23.53)	58 (15.10)	
VPS/VSGS	45 (14.71)	65 (16.93)	
Inguinal hernia repair	24 (7.84)	24 (6.25)	
Exploratory Laparotomy	17 (5.56)	41 (10.68)	
EA repair	12 (3.92)	2 (0.52)	
TEF repair/ligation	8 (2.61)	21 (5.47)	
DOL on surgical date, median (IQR)	32 (6-68)	37 (8-72.5)	0.319
PMA on surgical date (wks), median (IQR)	40.86 (38.00-44.14)	40.86 (38.43-44.29)	0.561
Weight on surgical date (kg), median (IQR)	3.00 (2.45-3.70)	3.30 (2.60-3.80)	0.089

Cohorts Defined by IV acetaminophen administration			
	IV acetaminophen	No IV acetaminophen	p-value
N	202	488	
Gestational Age (wks), mean (sd)	34.91 (4.84)	34.21 (5.31)	0.109
Sex, n (%)			0.802
Male	118 (58.42)	280 (57.38)	
Female	84 (41.58)	208 (42.62)	
Birthweight, median (IQR)	2515 (1690-3230)	2380 (1250-3135)	0.124
Primary Surgery, n (%)			0.312
G-Tube +/- fundus	86 (42.57)	215 (44.06)	
Colostomy/take down	38 (18.81)	92 (18.85)	
VPS/VSGS	33 (16.34)	77 (15.78)	
Exploratory Laparotomy	17 (8.42)	41 (8.40)	
TEF repair/ligation	14 (6.93)	15 (3.07)	
Inguinal hernia repair	12 (5.94)	36 (7.38)	
EA repair	2 (0.99)	12 (2.46)	
DOL on surgical date, median (IQR)	34.5 (6-65)	35 (8-72)	0.734
PMA on surgical date (wks), median (IQR)	40.71 (38.71-44.71)	40.86 (38.00-43.86)	0.276
Weight on surgical date (kg), median (IQR)	3.30 (2.70-3.80)	3.10 (2.50-3.70)	0.024

Results

Outcome Variable	Pre-Algorithm (n = 306)	Post Algorithm (n = 384)	P-value
Total 72 hr Opioid Exposure (mg), median (IQR)	1.09 (0.30 – 3.21)	0.57 (0 – 2.19)	<0.001
Incidence of Post-Operative Hypotension, n (%)	142 (46.56)	101 (26.44)	<0.001
Hours to Extubation (where time <=72), median (IQR)	n = 114 (37%) 25.83 (17.72 – 44.07)	n = 132 (34%) 22.28 (8.12 – 38.89)	0.004
Incidence of Respiratory Depression, n (%)	299 (98.03)	365 (95.55)	0.072
Time to first Stool (where 1 st stool is <=72hrs), median (IQR)	n = 264 (86%) 28 (13 - 44)	n = 325 (85%) 26 (13 - 41)	0.487
Time for first enteral feed (where 1 st feed is <=72 hrs), median (IQR)	n = 221 (72%) 22 (9 – 30)	n = 276 (72%) 12 (6 – 25)	<0.001
NPASS Scores, median (IQR)			
0-24	4 (3 – 5)	4 (3 – 5)	0.100
24-48	3 (1 – 4)	3 (1 – 4)	0.591
48-72	3 (1 – 4)	3 (1 – 4)	0.462

Table 1. Post-operative opiate exposure pre versus post implementation of pain control algorithm. Results are presented at median (IQR)

Outcome Variable	IV Acetaminophen (n = 202)	Non- IV Acetaminophen (n = 488)	P-value
Total 72 hours Opioid Exposure (mg), median (IQR)	0.67 (0.15 – 2.50)	0.83 (0.15 – 2.40)	0.678
Incidence of Post-Operative Hypotension, n (%)	56 (27.86)	187 (38.48)	0.008
Hours to Extubation (where time <=72), median (IQR)	n = 67 (33%) 20.40 (8.45 – 39.27)	n = 179 (37%) 24.92 (15.60 – 42.73)	0.051
Incidence of Respiratory Depression, n (%)	192 (95.52)	472 (97.12)	0.290
Time to first Stool (where 1 st stool is <=72hrs), median (IQR)	n = 177 (88%) 27 (13 - 43)	n = 412 (84%) 27 (13 - 42)	0.684
Time for first enteral feed (where 1 st feed is <=72hrs), median (IQR)	n = 149 (74%) 17 (6 – 26)	n = 348 (71%) 20 (7 – 27)	0.118
NPASS Scores, median (IQR)			
0-24	4.5 (3 – 5)	4 (3 – 5)	<0.001
24-48	4 (1 – 5)	3 (1 – 4)	0.228
48-72	3 (1 – 5)	3 (1 – 4)	0.132

Table 2. Comparison of post-operative opiate exposure between infants who did and did not receive IV acetaminophen in the 72 hour post operative period. Results are presented as median (IQR)

Figure 1: Morphine Exposure by Cohort

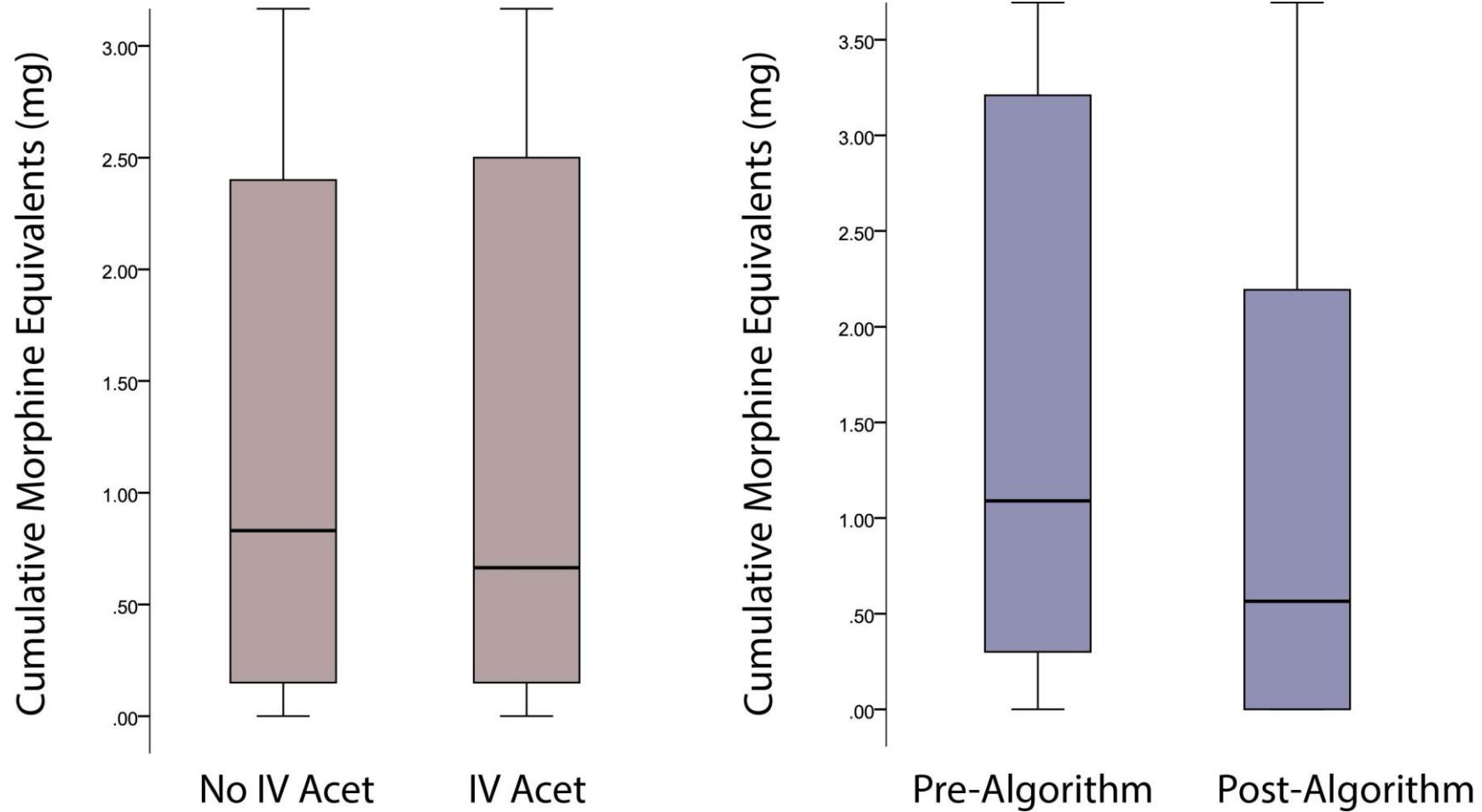
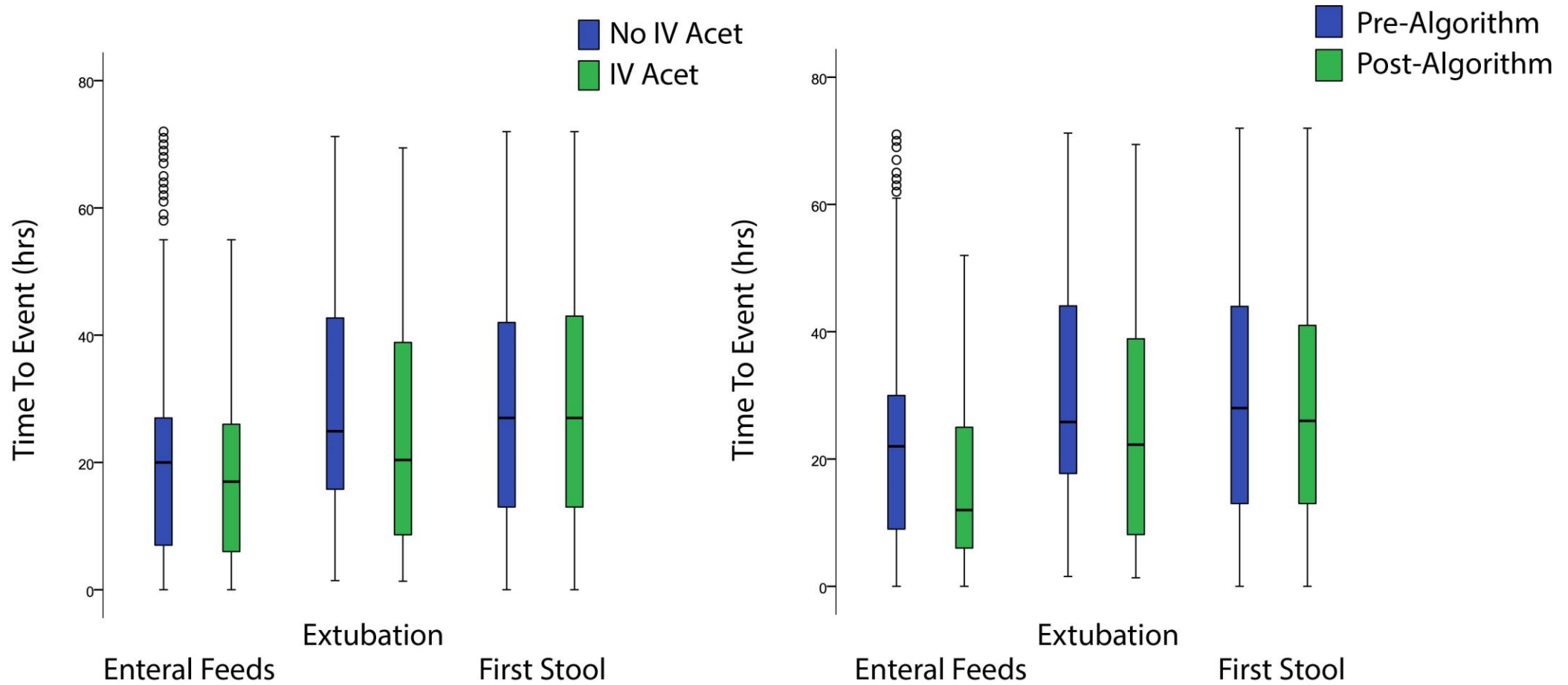


Figure 2: Time to Post-Op Event by Cohort



Conclusions

- Implementation of a post-op pain algorithm in the NICU significantly reduced cumulative opioid exposure and the incidence of post-operative hypotension
- The time to the first enteral feed and the hours to extubation were also significantly reduced by a post-op pain algorithm.
- Although post-op opiate exposure was not significantly different between those who did and did not receive IV acetaminophen, post-op hypotension was reduced with acetaminophen exposure

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