Painful Procedures Correlate With Markers of Hypoxia, Oxidative Stress and Intestinal Injury in Premature Neonates

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Eight Years Later, Are We Still Hurting Newborn Infants?

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Table 2. Incidences of procedures in 2001 and 2009, with frequencies per infant per day and p values comparing frequencies

Procedure	Percent of total procedures		Frequency per infant per day (mean ± SD)		SDM	p value
	2001 (n = 151)	2009 (n = 175)	2001	2009		
Nasal suctioning	31.2	31.6	4.5±2.3	3.4±2.2	0.49	<0.001
Endotracheal suctioning	23.0	23.0	3.3±4.0	2.5±3.5	0.21	0.06
NPT suctioning	9.4	5.7	1.3±2.4	0.6±1.2	0.37	<0.001
Heel lancing	7.1	10.7	1.0±1.6	1.5±1.1	0.36	0.001
Intravenous cannula insertion	3.8	3.2	0.5±0.6	0.4±0.3	0.21	0.06
Nasogastric tube insertion	3.8	1.9	0.5±0.6	0.2±0.1	0.70	<0.001
Intravenous cannula removal	3.2	2.2	0.5±0.7	0.3±0.2	0.39	<0.001
Nasogastric tube removal	3.1	1.0	0.4±0.5	0.1±0.1	0.83	<0.001
X-ray					0.15	0.17
NPT insertion					0.20	0.08
Failed intravenous cannula insert					0	1.0
Laxative or enema	1.2	1.1	0.2±0.5	0.1±0.1	0.28	0.01
Nasal oxygen cannula insertion	1.0	1.0	0.2±0.4	0.1±0.2	0.32	0.004
Intubation	0.9	0.6	0.1±0.4	0.08±0.08	0.07	0.52
Peripheral arterial line insertion	0.8	0.4	0.1±0.3	0.05±0.07	0.23	0.04
Extubation	0.7	0.5	0.1±0.3	0.06±0.08	0.18	0.09
Peripheral arterial line removal	0.6	0.3	<0.1±0.3	<0.1±0.06		
Failed peripheral arterial line insertion	0.5	0.8	<0.1±0.5	<0.1±0.06		
Venipuncture	0.4	0.2	<0.1±0.3	<0.1±0.1		
Insertion umbilical line	0.4	0.3	<0.1±0.2	<0.1±0.05		
Removal umbilical line	0.3	0.4	<0.1±0.2	0.1±0.1		
Failed umbilical line insertion	0.2	0.2	<0.1±0.2	<0.1±0.06		
Insertion central line	0.2	0.4	<0.1±0.2	<0.1±0.05		
Insertion chest tube	0.1	0.2	<0.1±0.2	<0.1±0.1		
Failed central line insertion	0.1	0.2	<0.1±0.2	<0.1±0.09		
Venipuncture attempt	0.1	0.02	<0.1±0.2	<0.1±0.03		
Removal central line	0.1	0.2	<0.1±0.1	<0.1±0.05		
Removal chest tube	0.1	0.07	<0.1±0.1	<0.1±0.04		

11.4± 5.7 per day

NPT = Nasopharyngeal tube; SDM = standardized mean difference.

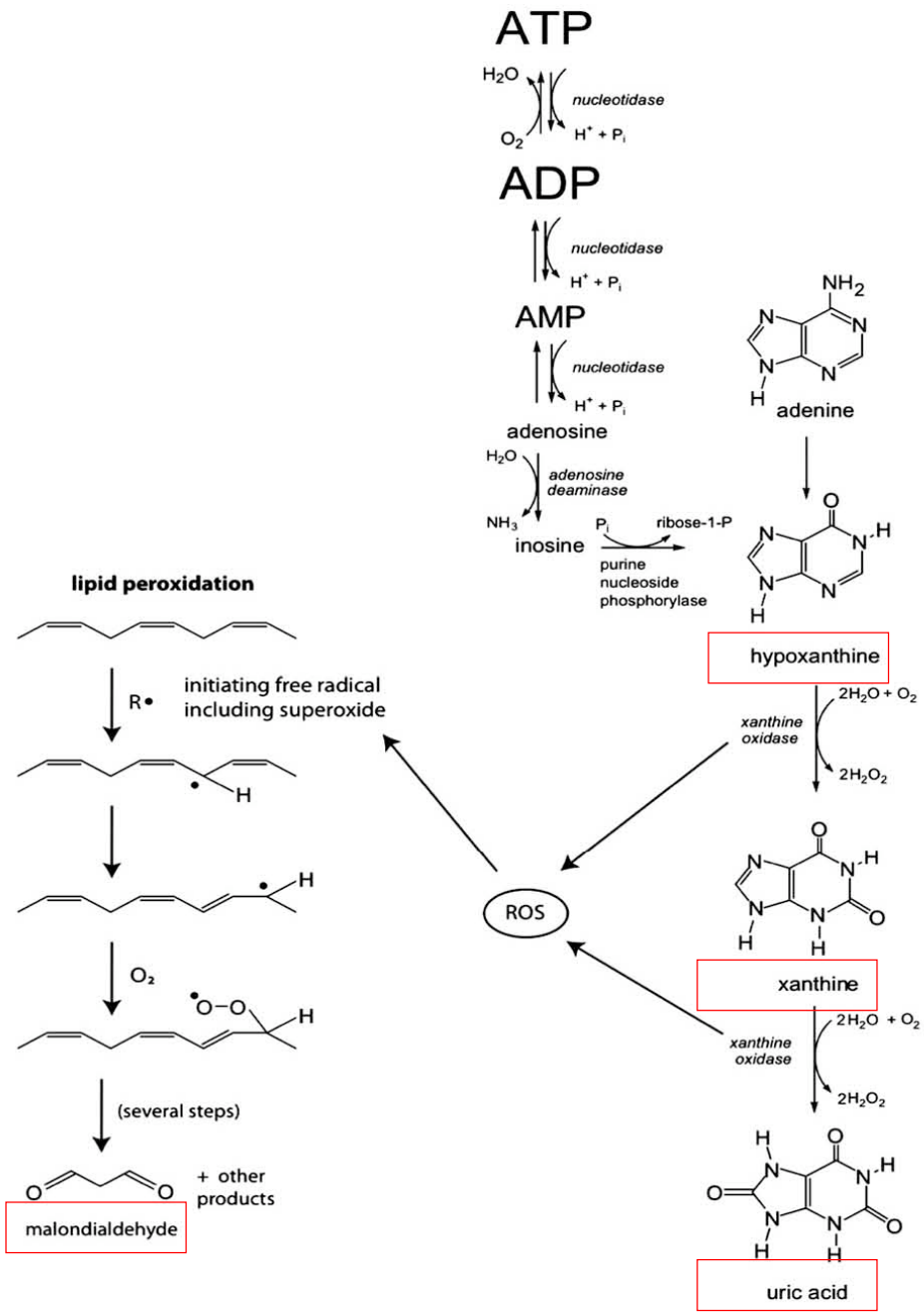

Figure 1. Pathway from ATP to UA and MDA.

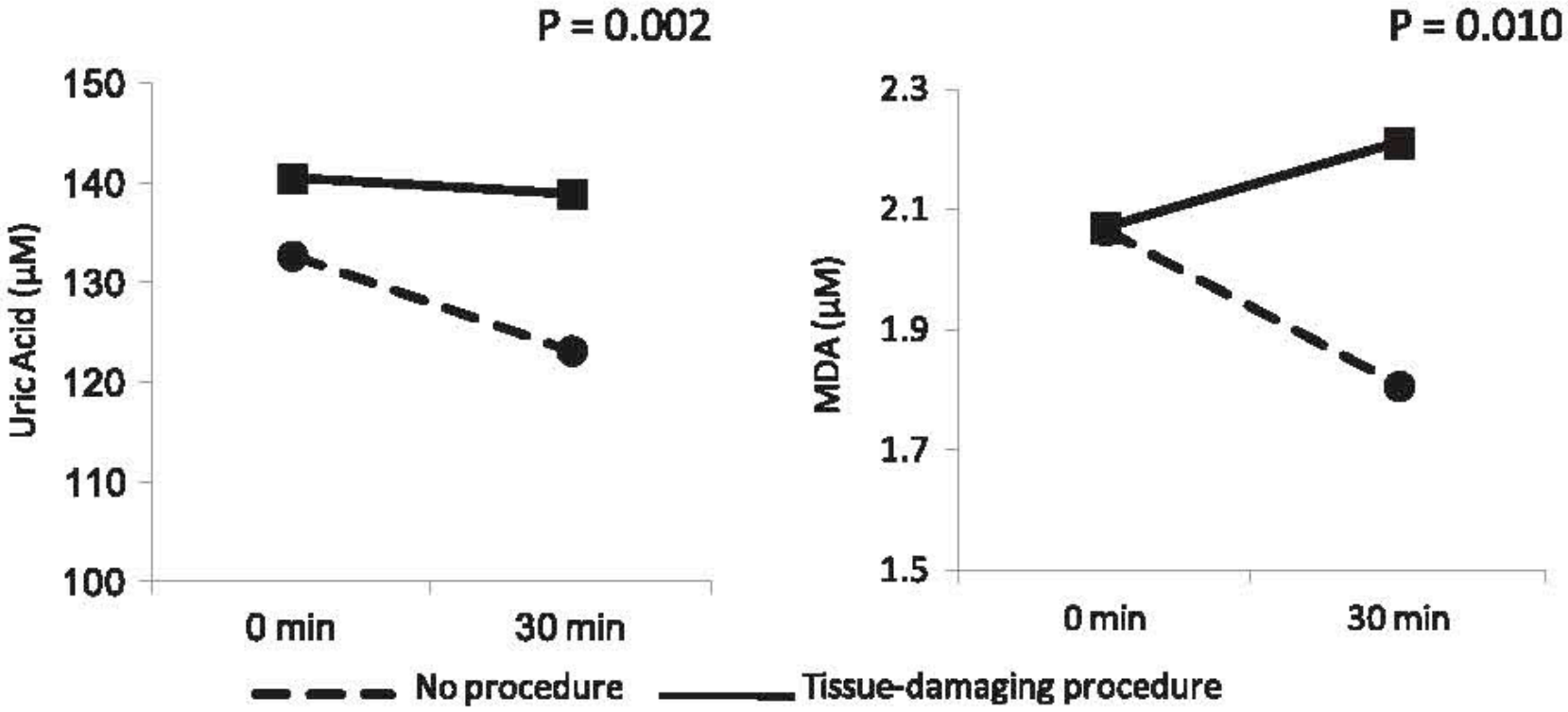

Figure 2. Plasma [UA] and [MDA] at baseline and 30 minutes post-TDP.

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Procedural Pain and Oxidative Stress in Premature Neonates

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Research Team

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- Reseach Technicians: Yayesh Asmerom MS
- PhD students: Teleka Patrick MD, PhD, Megan Holden PhD, **John Tan, PhD**
- LLU Children's hospital nurses doctors


200
LVPEI

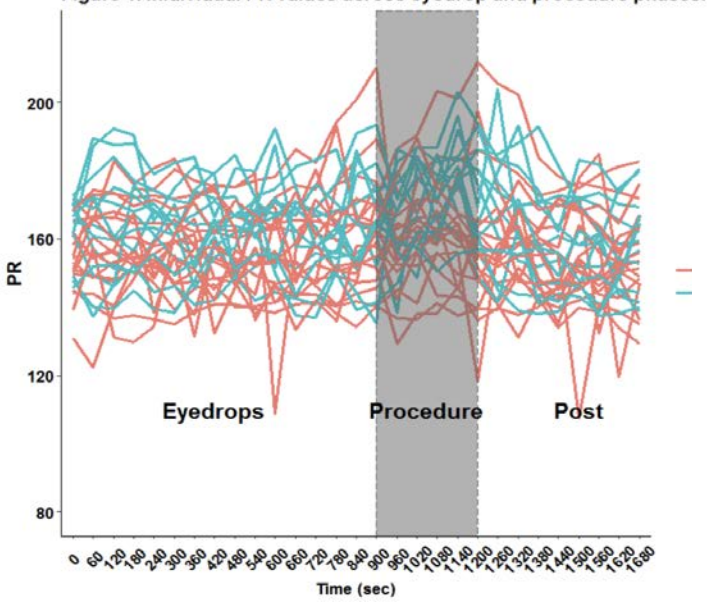
	On Room Air (n=19)	Receiving Oxygen (n=23)	P value[#]
Birthweight (g)	1220 ± 426	886 ± 279	0.004
Birthweight @Exam time	2352 ± 724	1804 ± 575	0.009
Gestational Age (wks)	29.5 ± 2.2	27.1 ± 2.1	0.001
Gestational Age@ Exam time	36.5 ± 2.6	34.6 ± 2.8	0.030
Apgar-1 min	4.8 ± 1.9	3.9 ± 2.5	0.157
Apgar-5 min	7.1 ± 1.2	6.5 ± 2.1	0.300
Gender	Female: 9 Male: 10	Female: 8 Male: 15	0.408[+]
SNAPPE_II	15.1 ± 10.9	22.9 ± 15.2	0.06
Ethnicity	African-American: 6 Asian: 2 Hispanic/Latino: 1 Caucasian: 6 Other/More than one race: 0 Unknown: 2	African-American: 1 Asian: 1 Hispanic/Latino: 2 Caucasian: 14 Other/More than one race: 4 Unknown: 1	0.29[+]
#ROP exam	2.2 ± 1.7	2.3 ± 1.6	0.909
Mode of oxygen support	Spontaneous room air = 19	CPAP: 4 HFNC:11 Nasal cannula: 3 NAVA: 2 NCPAP: 1 NIMV: 1 NIPPV: 1	< 0.001[+]

Adverse effects of ROP exam

- Conflicting findings
  - No differences in apnea, bradycardia or oxygen desaturation 24-72 hours after the exam (Reid et al, 2017; Klein et al, 2008)
  - Increased apnea events (Mitchell et al, 2016; Reid et al, 2017)
  - Decreased gastric emptying (Bonthala et al, 2000)
  - Transient ileus (Degirmencioglu et al, 2014;

Effect on HR

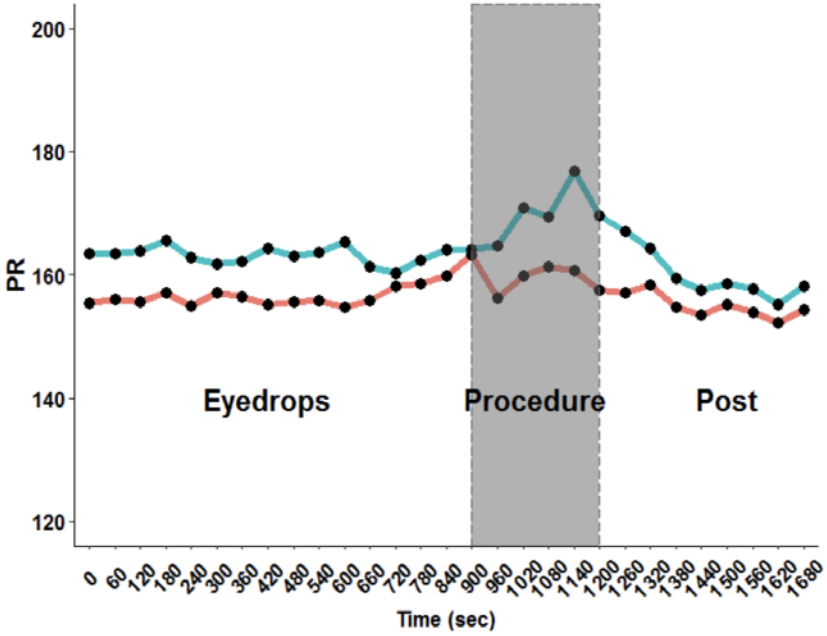
Figure 1. Inidividual PR values across eyedrop and procedure phases.



Receiving FiO_2 ≥30%

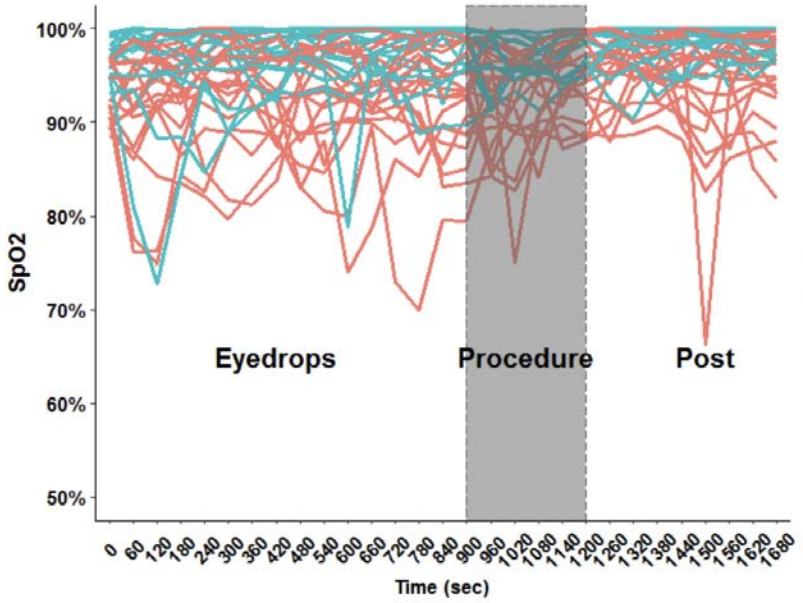
Spontaneous Room Air

Figure 2. Average PR values across eyedrop and procedure phases by room air group.



Effect on SPO_2

Figure 1. Inidividual SpO2 values across eyedrop and procedure phases.



Receiving FiO_2 ≥30%

Spontaneous Room Air

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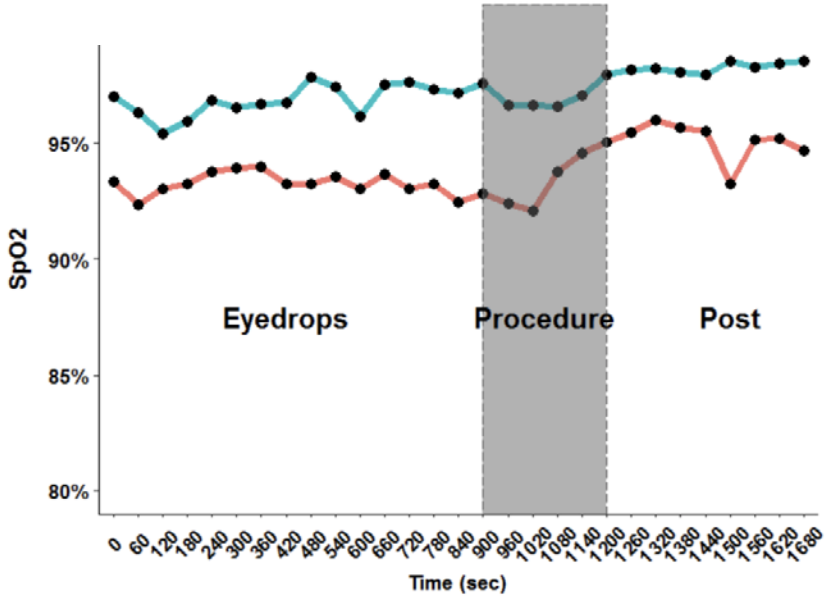
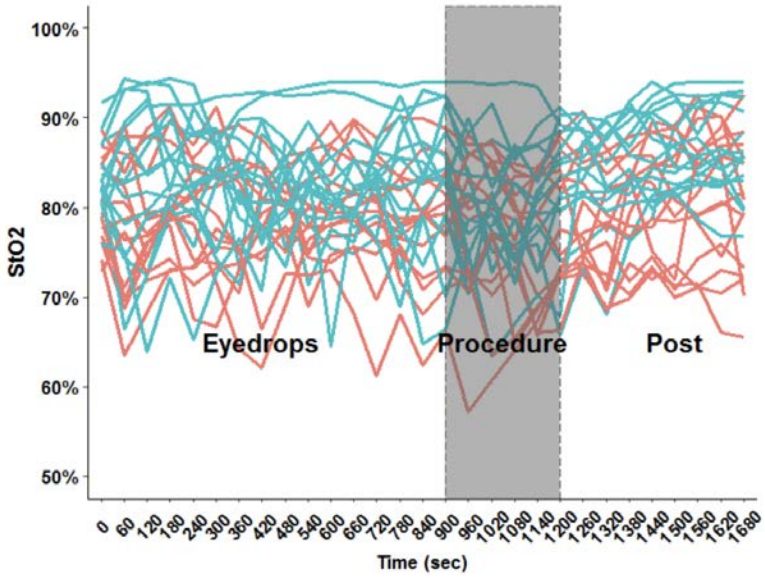


Effect on StO_2

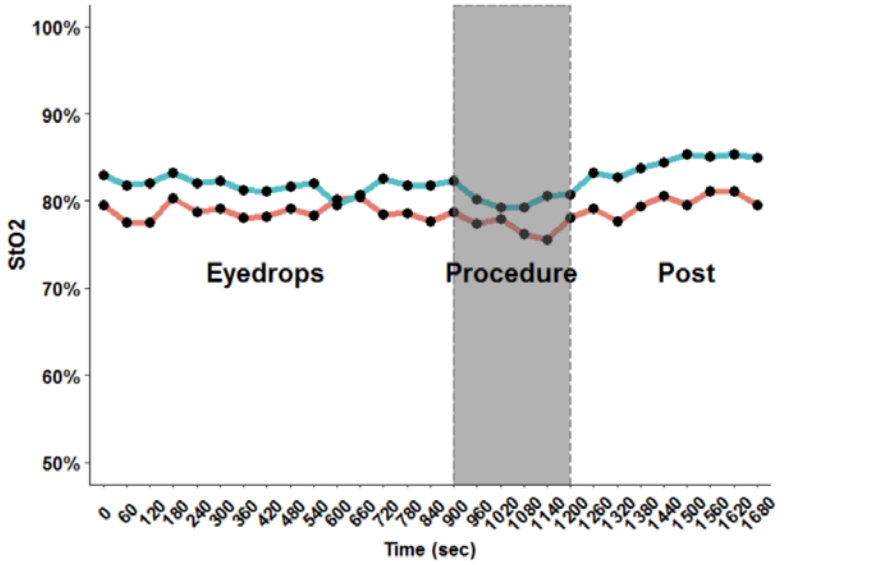
Figure 1. Inidividual StO2 values across eyedrop and procedure phases.

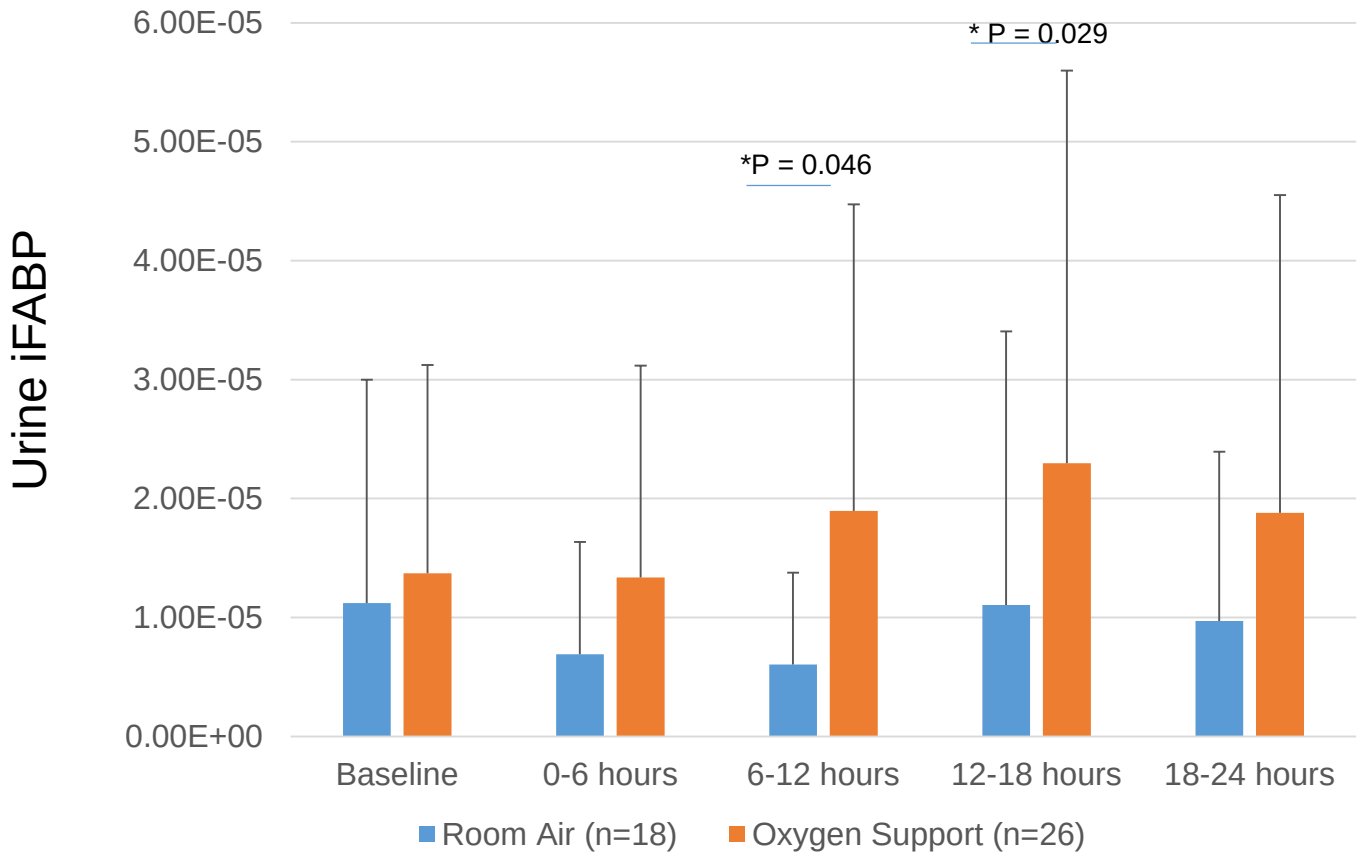


Receiving FiO_2 ≥30%

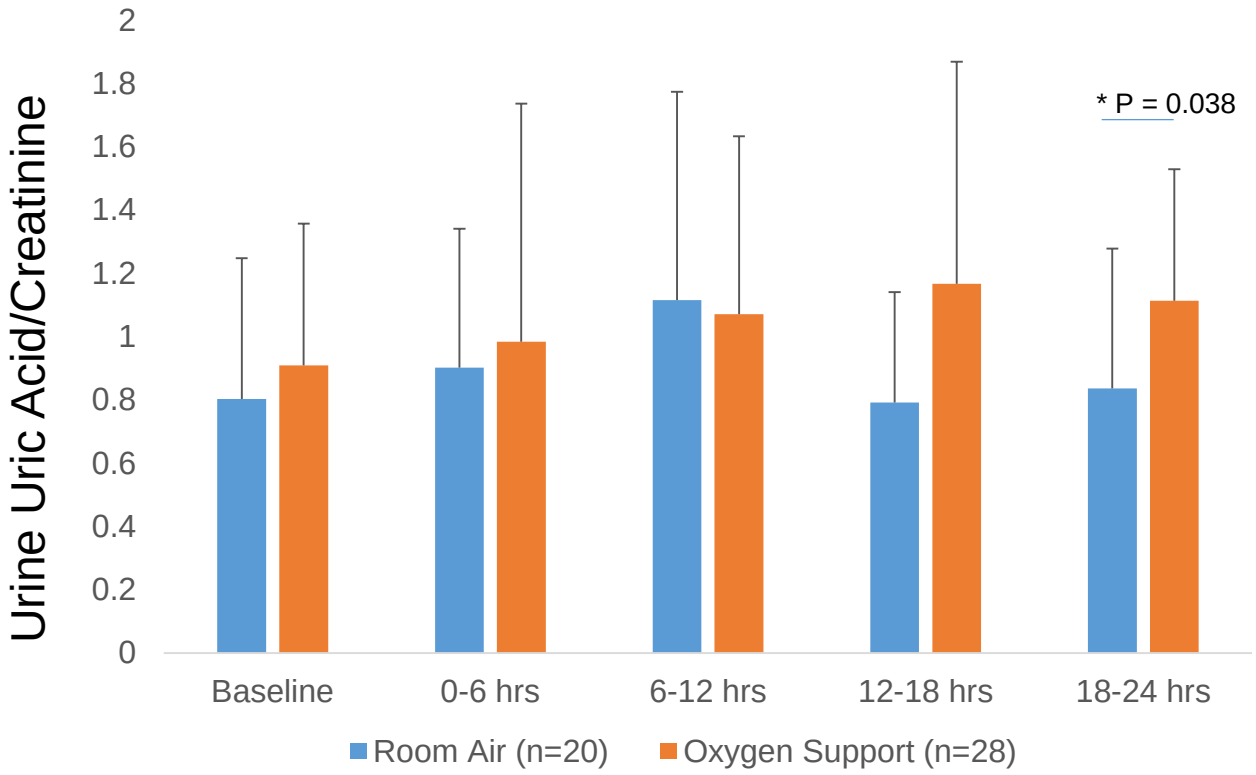
Spontaneous Room Air

Figure 2. Average StO2 values across eyedrop and procedure phases by room air group.





* Mann-Whitney



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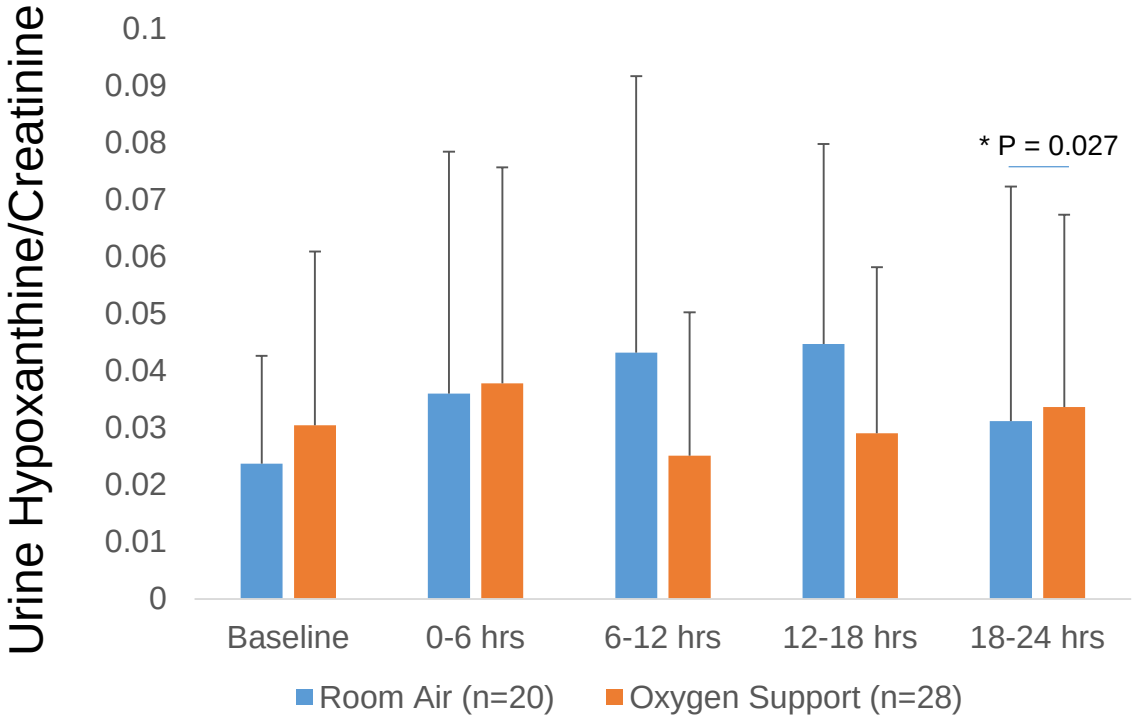

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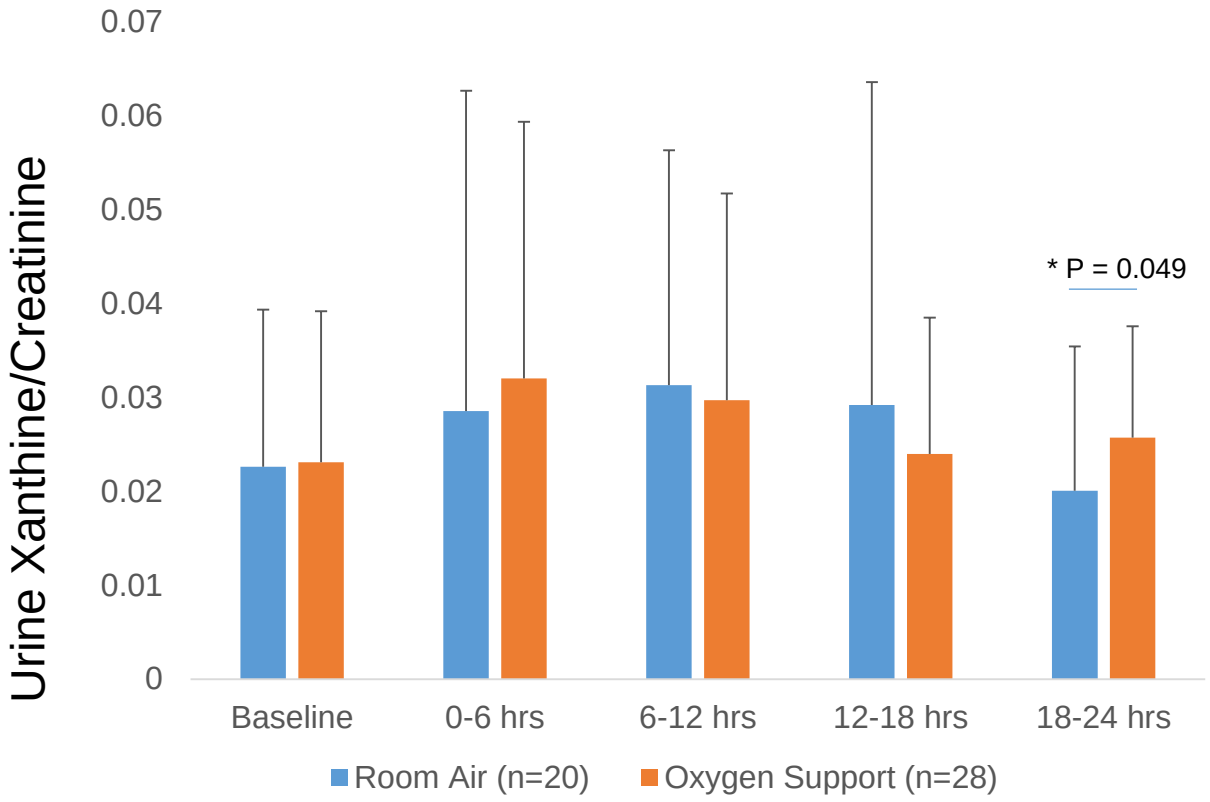

* Mann-Whitney

Next step?

- Examine mechanism of injury in neonates on oxygen
- Determine minimum mydriatic dosage, specifically for neonates on oxygen
- Examine current feeding protocols
- Perform a study with larger sample size