Outcomes Predictors for Small for Gestational Age Neonates in the NICU

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BACKGROUND

- Intrauterine growth restriction (IUGR) is defined <10th percentile based on fetal biometric measures. Causes for IUGR include: multiple gestation, hypertension (HTN)/preeclampsia, chromosomal or genetic syndromes, intrauterine viral or parasitic infections, other chronic illnesses, medication/drug exposure, or nutritional disorders.
- Obstetrical (OB) management of IUGR includes umbilical artery Doppler velocimetry to predict adverse outcome risk, guide optimal timing of delivery, improve perinatal outcomes.
- IUGR increases risk of fetal/neonatal mortality, asphyxia, NICU morbidities, prematurity, thermoregulation, hypoglycemia, & measuring small for gestational age (SGA) after birth.
- Literature studying antenatal factors & neonatal complications is limited or conducted before current OB antenatal IUGR monitoring.

Figure 1: OB Testing
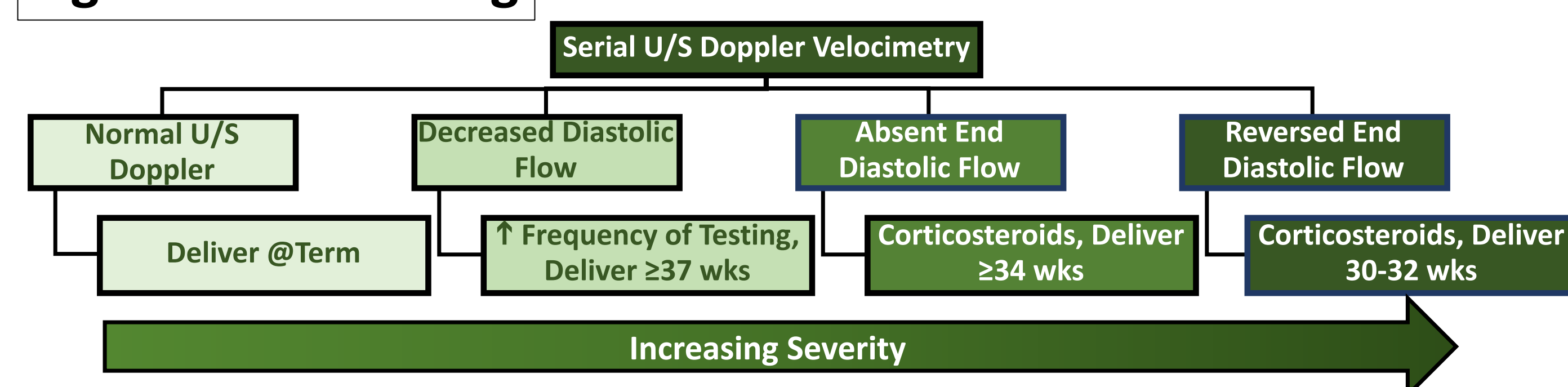
AIMS/HYPOTHESIS

To analyze the prevalence of pregnancy factors on the incidence of SGA, as well as the rates of perinatal & postnatal NICU complications.

METHODS

- Project approved by UnityPoint Meriter & UW-Health IRB.
- Data compiled using 2448 neonates admitted at UnityPoint Health Meriter NICU, 93% inborn, from data entered into the Vermont-Oxford Network (VON) dataset.
- Inclusion Criteria: All gestational age ≥30 weeks gestation due to best OB practices for serial antenatal monitoring for timing of delivery.
- SGA ≤10th percentile birth weight on Fenton growth curves.
- Those ≤10th % further categorized into SGA subgroups; ≤10th but >5th % (10th-5th) & ≤5th % (<5th).
- SGA ≤10th % group was categorized as head circumference ≤10th % symmetrical), or head circumference >10th % (asymmetrical).

DATA ANALYSIS

- Data were analyzed using STATA 15.
- Composite outcomes 'respiratory assistance' and 'any complication' were defined as neonates required ventilation or CPAP and having a life threatening complication, respectively.
- Differences in rates of characteristics or outcomes by group were compared using Chi-squared testing.
- Outcome variables considered significant (P<0.05) were entered into multivariate logistic regression model to examine interactions, including HTN because it co-occurred with SGA.

RESULTS

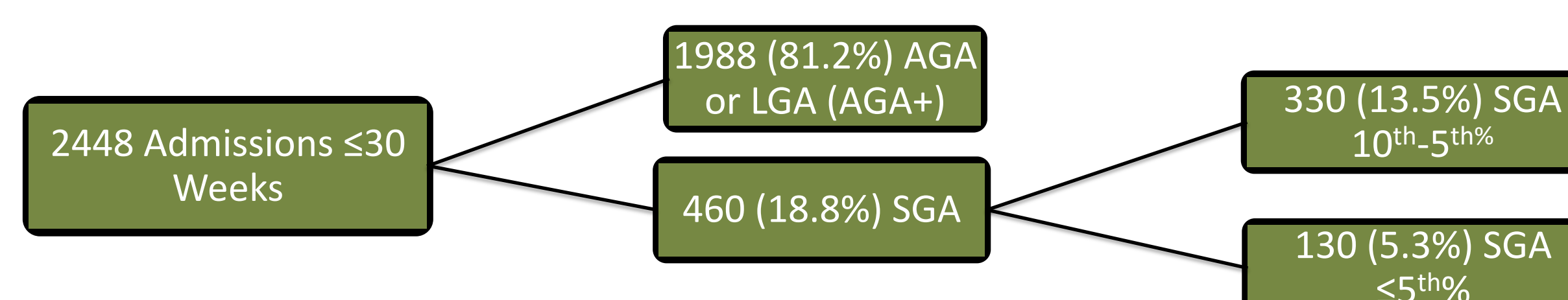### Figure 2: Rates of SGA in Cohort & By Groups

Table 1: Characteristics & Outcomes

	n=All		AGA Neonates		SGA 10th-5th%		SGA <5th%		P values
Total Amount	2448	100.0%	2015	82.3%	314	12.8%	119	4.9%	
Gestational Age (Median) (Weeks)	37		37		36		37		0.0001
Sex - Male	1408	57.5%	1163a	57.7%	185(b)	58.9%	60(c)	50.4%	0.219
Maternal Race - White	1812	74.0%	1484a	73.6%	245ab	78.0%	83a(c)	69.7%	0.21
Antenatal Steroids	642	26.2%	522a	25.9%	99b	31.5%	21c	17.6%	0.011
Maternal Hypertension	633	25.9%	466a	23.1%	131(b)	41.7%	36(c)	30.3%	0.0001
Multiple Gestation	349	14.3%	253a	12.6%	74b	23.6%	22(b)	18.5%	0.0001
Congenital Anomaly	208	8.5%	158a	7.8%	36b	11.5%	14ab	11.8%	0.037
Birth Weight (grams)	2840		3090a		2272b		2025c		0.001
Head Circum ≤10% @Birth	252	10.3%	106a	5.3%	69b	22.0%	77c	64.7%	0.0001
Outcomes									
Head Circum ≤10% @Disposition	259	10.6%	95	4.7%	86	27.4%	78	65.5%	0.0001
Change -0.8 in Weight Z-score at Disposition	486	19.9%	369a	18.3%	90b	28.7%	27a	22.7%	0.0001
Chorioamnionitis	205	8.4%	195a	9.7%	8b	2.5%	2b	1.7%	0.0001
Respiratory Assistance	1454	59.4%	1209(a)	60.0%	184ab	58.6%	61b	51.3%	0.14
Respiratory Distress Syndrome	289	11.8%	247a	12.3%	36a	11.5%	6b	5.0%	0.065
Surfactant Given	150	6.1%	136a	6.7%	13(b)	4.1%	1c	0.8%	0.012
Mortality	33	1.3%	26	1.3%	5	1.6%	2	1.7%	0.75
Any Complication	433	17.7%	381a	18.9%	36b	11.5%	16ab	13.4%	0.003

Within all groups (AGA, SGA<10th, and SGA<5th), differences in characteristics or outcomes (p<0.05 is bolded). Between group *post hoc* differences (or trends) are denoted by different letters.

Figure 3: Characteristics & Outcomes
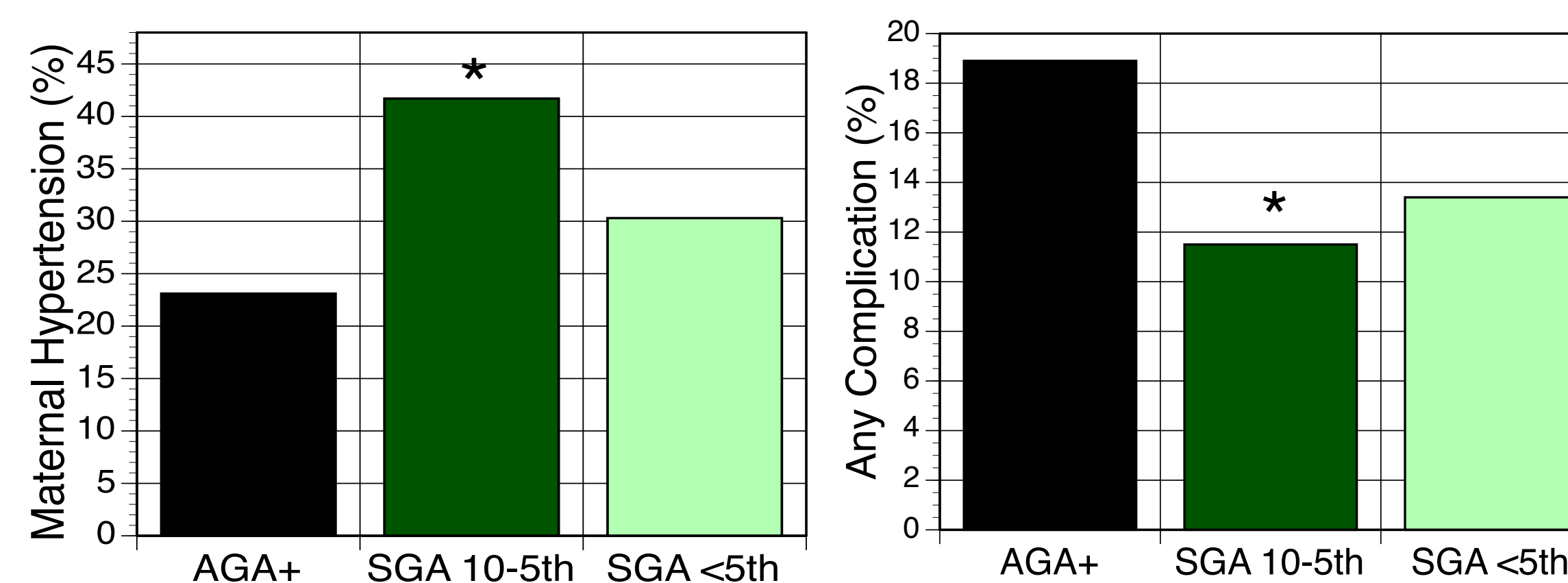
Maternal HTN was more common in SGA 10-5th vs. AGA+ or SGA 5th groups. Any complication was lower or trended lower in SGA groups.

RESULTS

Table 2: Predictors & Outcomes in SGA vs. Not

Predictors of SGA	Odds Ratio	95% confidence limits	P-Value
Multiple Gestation	1.93	1.487-2.50	0.0001
Maternal Hypertension	2.01	1.62-2.50	0.0001
Congenital Anomaly	1.53	1.09-2.14	0.01
Outcomes Table	**Odds Ratio**	**95% confidence limits**	***P-Value***
Head Circumference ≤ 10%	5.59	4.59-6.81	0.0001
Disposition Delta -0.8 in Weight z score	1.31	1.10-1.56	0.0001
Chorioamnionitis	0.34	0.21-0.56	0.0001
Seizures	1.81	0.97-3.37	0.060
Respiratory Assistance	0.87	0.75-1.02	0.085
Respiratory Distress Syndrome	0.75	0.58-0.99	0.040
Surfactant Given	0.49	0.31-0.79	0.0001
Any Complication	0.7	0.56-0.89	0.0001

Order logistic regression showed no interactions between any of these outcomes

The significant predictors of all SGA are shown, as are NICU outcomes in SGA vs. AGA that differed or trended. Note that being SGA was protected from chorioamnionitis, respiratory outcomes, and from any complication.

CONCLUSIONS

Predictors
- Maternal HTN & multiple gestation pregnancies were prevalent & roughly doubled the risk of delivering an SGA neonate.
- Maternal HTN was associated with asymmetrical head-sparing SGA.

NICU Complications
- SGA cohort had less complications related to pulmonary function, but poorer growth velocity during NICU stay.
- Although antenatal steroid use was lower, ventilation support, RDS & surfactant administration was also lower in SGA ≤5th group.
- Despite most literature supporting worse outcomes than AGA neonates, medical outcomes in NICU neonates ≥30 weeks gestation measuring SGA were generally not worse.
- Study was limited by its retrospective nature, but is a representative sampling

It is important for clinicians to recognize risks for SGA & counsel families about short-term outcomes in in contemporary practice.

ACKNOWLEDGEMENTS

Conflicts of Interest

The authors have no conflicts of interest to declare.