

Risk Factors for Neonatal Acidosis Among Patients with Umbilical Cord Prolapse: a Single Center Study

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- We aimed to identify maternal and clinical characteristics associated with neonatal acidosis among patients with umbilical cord prolapse.
- We hypothesized that maternal and clinical factors (specifically timing to delivery) are associated with neonatal acidosis.

Methods

- We conducted a retrospective observational cohort study at a single institution.
- Patients who delivered live born infants at our hospital from January 1, 2019 to December 31, 2024 with umbilical cord prolapse and had complete umbilical cord blood gas pH data were included in the final analysis.
- Neonatal acidosis was defined as a cord blood gas pH less than 7.
- We compared patients with and without neonatal acidosis using bivariate analyses and then performed a multivariate logistic regression using variables of interest to identify characteristics independently associated with neonatal acidosis.

Results

- There were 67 patients who had umbilical cord prolapse during the study period and 17 were excluded due to missing cord blood gas pH values.
- Preeclampsia was independently associated with neonatal acidosis in the multivariate logistic regression
- C-statistic of multivariate logistic regression was 0.91

Table 2. Multivariate logistic regression to predict cord blood gas pH less than 7.0

Variable	Units	Odds ratio	95% Confidence intervals		P value
Gestational age	2 weeks	6.00	0.85	42.39	0.07
Preeclampsia diagnosis	Yes	27.49	1.86	405.73	0.02
Time from entering operating room until delivery	5 minutes	1.68	0.85	3.32	0.14

Table 1. Patient demographic, physical, and clinical characteristics

Variable	Cord blood gas pH less than 7.0 (N=6)	Cord blood gas pH 7.0 or greater (N=44)	P value
Race^a			0.46
<i>Black or African American</i>	1 (17%)	3 (7%)	
<i>Hispanic</i>	2 (33%)	9 (21%)	
<i>White or Caucasian</i>	3 (50%)	30 (71%)	
Age (years) (mean (SD))	30 ± 6	29 ± 6	0.86
Height (cm) (mean (SD))	162.2 ± 8.3	164.2 ± 7.4	0.59
Weight (kg) (mean (SD))	91.0 ± 16.8	96.0 ± 23.1	0.53
Body mass index (kg/m²) (mean (SD))	36.4 ± 8.4	35.6 ± 8.8	0.84
Gravidity (median (IQR))	2 (2-3)	3 (1-4)	0.87
Parity (median (IQR))	1 (0-2)	1 (0-2)	0.74
Gestational age (weeks) (median (IQR))	39.0 (39.0-39.6)	37.3 (35.0-39.0)	0.05
Multiple gestation (yes)	0	4 (9%)	1.00
History of cesarean delivery (yes)	2 (33%)	2 (4%)	0.07
Vertex presentation (yes)	5 (83%)	39 (89%)	0.56
Maternal co-morbidities			
<i>Preeclampsia diagnosis (yes)</i>	4 (67%)	8 (18%)	0.02
<i>Oligohydramnios diagnosis (yes)</i>	0	4 (9%)	1.00
<i>Maternal diabetes (any type) (yes)</i>	0	2 (4%)	1.00
<i>Fetal growth restriction (yes)</i>	0	3 (7%)	1.00
Induction of labor (IOL)			
<i>Induction of labor (yes)</i>	5 (83%)	29 (66%)	0.65
<i>Foley bulb for cervical ripening (yes)</i>	4 (67%)	25 (57%)	1.00
<i>Misoprostol administered for cervical ripening (yes)</i>	3 (50%)	21 (48%)	1.00
Rupture of membranes			
<i>Ruptured membranes at presentation (yes)</i>	1 (17%)	9 (20%)	1.00
<i>Artificial rupture of membranes (yes)</i>	5 (83%)	30 (68%)	0.65
<i>Cord prolapse with artificial rupture of membranes (yes)</i>	3 (50%)	18 (41%)	0.69
Anesthesia use/type			
<i>Labor epidural analgesia (yes)</i>	3 (50%)	22 (50%)	1.00
<i>General anesthesia prior to delivery (yes)</i>	6 (100%)	41 (93%)	1.00
Time from entering operating room until delivery (minutes) (median (IQR))	8 (8-11)	10 (8-12)	0.56
Time from incision until delivery (minutes) (median (IQR))	2 (1-3)	2 (1-2)	0.94
APGAR score at 1 minute (median (IQR))	1 (1-1)	8 (3-8)	0.001
APGAR score at 5 minutes (median (IQR))	5 (4-6)	9 (7-9)	0.003
Cord blood gas pH (mean (SD))	6.88 ± 0.11	7.19 ± 0.09	<0.001
Birthweight (gm)	3195 (2930-4260)	2930 (2115-3525)	0.10

a. Two patients had incomplete data

Conclusions

- Among patients with umbilical cord prolapse, those with preeclampsia were 27 times more likely to have neonatal acidosis
- Although preeclampsia is not a common risk factor for umbilical cord prolapse, its association with neonatal acidosis may reflect placental dysfunction and reduced fetal reserve, increasing susceptibility to neonatal acidosis during umbilical cord prolapse.
- Iatrogenic prematurity and unmeasured disease severity such as growth restriction or oligohydramnios may also contribute.
- The time from entering the operating room to delivery was similar between neonates who did and did not have neonatal acidosis.
- The c-statistic of 0.91 suggests that our multivariate logistic regression has high predictability.
- Study limitations include small sample size and missing cord blood gas data.
- Future large studies are needed to determine additional risk factors for neonatal acidosis in the setting of umbilical cord prolapse.