

Acid Base Case Examples

Jon Palmer, VMD, DACVIM
Chief, Neonatal Intensive Care Service
New Bolton Center, University of Pennsylvania, USA

Case 1

- 30 hr old Friesian filly
- Septic Shock – *E. coli* bacteremia
- Other problems:
 - Mild pharyngeal collapse, Neonatal Encephalopathy, Neonatal Gastroenteropathy (reflux, dysmotility), hypothermia, premature ventricular contractions ...
- 12 day hospital stay

Case 1

Cr	4.5 mg/dl
BUN	28 mg/dl
HCO ₃	10.3 mmol/l
Na	134.7 mmol/l
K	4.68 mmol/l
Cl	102 mmol/l
Ca ⁺⁺	5.31 mg/dl
Mg ⁺⁺	1.08 mg/dl
Lac	16.4 mmol/l
PO ₄	7.36 mg/dl
Alb	2.3 g/dl
Glob	2.0 g/dl



Septic Shock		mEq/l
pH	7.195	
Pco ₂	26.4	
SBE	-15.9	
HCO ₃	10.3 mmol/l	10.3
Na	134.7 mmol/l	134.7
K	4.68 mmol/l	4.68
Cl	102 mmol/l	102
Ca ⁺⁺	5.31 mg/dl	2.66
Mg ⁺⁺	1.08 mg/dl	0.9
Lac	16.4 mmol/l	16.4
PO ₄	7.36 mg/dl	4.34
Alb	2.3 g/dl	5.18
Glob	2.0 g/dl	2.8

Case 1

Septic Shock

Mg⁺⁺ = 0.9
 Ca⁺⁺ = 2.66
 K⁺ = 4.68



PO₄⁻ = 4.34
 Alb⁻ + Glob = 7.98
 HCO₃⁻ = 10.3
 Lac⁻ = 16.4

Case 2

- 3 hr old STD filly
- Born 2:30 pm – attended
 - Premature placental separation
 - Birth arrhythmia
- Problems
 - Fetal distress
 - Neonatal Encephalopathy, hypothermia (85F), early urination (4 hr), lactic acidosis, hypochloremic alkalosis

Case 2

Cr	26.9 mg/dl
BUN	18 mg/dl
HCO ₃	9.2 mmol/l
Na	142 mmol/l
K	4.13 mmol/l
Cl	88 mmol/l
Ca ⁺⁺	5.49 mg/dl
Mg ⁺⁺	2.49 mg/dl
Lac	?? mmol/l
PO ₄	27.8 mg/dl
Alb	2.97 g/dl
Glob	1.73 g/dl



Case 2

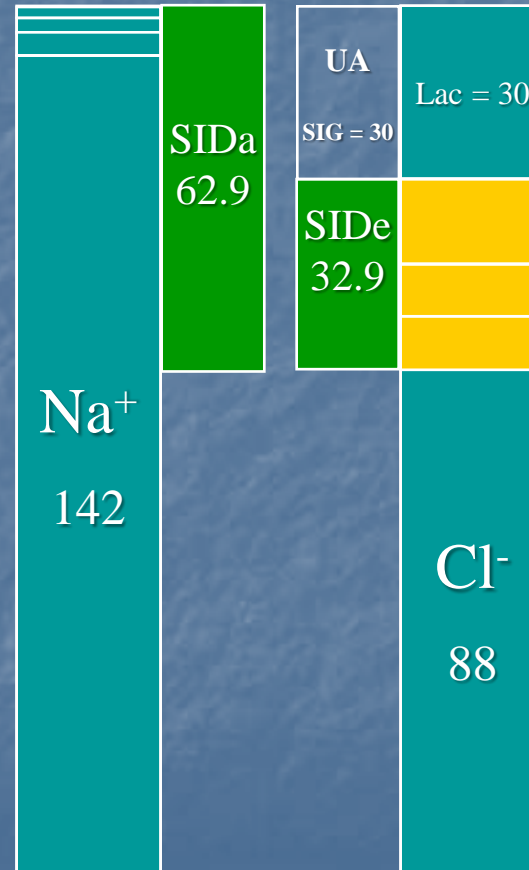
UA

		mEq/l
pH	6.791	
Pco ₂	59.6	
HCO ₃	9.2 mmol/l	9.2
SBE	-22.5 mEq/l	-22.5
Na	142 mmol/l	142
K	4.13 mmol/l	4.13
Cl	88 mmol/l	88
Ca ⁺⁺	5.49 mg/dl	2.74
Mg ⁺⁺	2.49 mg/dl	2.04
Lac	??	??
PO ₄	27.8 mg/dl	16.4
Alb	2.97 g/dl	6.7
Glob	1.73 g/dl	2.4

Mg⁺⁺ = 2.04

Ca⁺⁺ = 2.74

K⁺ = 4.13



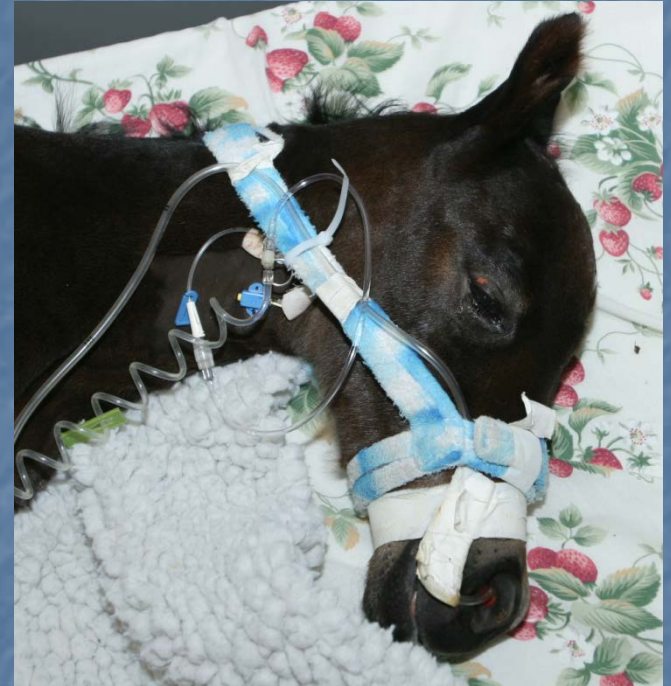
$\text{PO}_4^- = 14.6$

$\text{Alb}^- + \text{Glob}^- = 9.1$

$\text{HCO}_3^- = 9.2$

Case 3

- 16 hr old STD filly
- History
 - Foaling unexpected
 - Born in a field
 - Never stood
 - Nursed from bottle
- Problems
 - FIRS/IUGR/prematurity (4 weeks)
 - NE
 - NG (distension, fetal diarrhea)
 - Sepsis, coagulopathy, hypoperfusion
 - Respiratory failure
 - $Paco_2 > 100$
 - Refused ventilation



Case 3

Cr	5.53 mg/dl
BUN	28 mg/dl
HCO ₃	46.1 mmol/l
Na	142 mmol/l
K	3.4 mmol/l
Cl	75 mmol/l
Ca ⁺⁺	4.69 mg/dl
Mg ⁺⁺	0.78 mg/dl
Lac	9.8 mmol/l
PO ₄	11.5 mg/dl
Alb	2.45 g/dl
Glob	3.05 g/dl



		mEq/l
pH	7.424	
Pco ₂	69.8	
HCO ₃	46.1 mmol/l	46.1
SBE	20.5	20.5
Na	142 mmol/l	142
K	3.4 mmol/l	3.4
Cl	75 mmol/l	75
Ca ⁺⁺	4.69 mg/dl	2.35
Mg ⁺⁺	0.78 mg/dl	0.65
Lac	9.8 mmol/l	9.8
PO ₄	11.5 mg/dl	6.79
Alb	2.45 g/dl	5.51
Glob	3.05 g/dl	4.3

Case 3

Mg⁺⁺ = 0.68
 Ca⁺⁺ = 2.35
 K⁺ = 3.4



PO₄⁻ = 6.79
 Alb⁻ + Glob = 9.81
 HCO₃⁻ = 46.1
 Lac⁻ = 9.8

Case 4

- 4.5 hr STD filly
- History
 - Mare dripping fluids in field
 - Foaled uneventfully
 - Passed membranes 20 minutes
- Problems
 - Fetal distress – Cr 9.6, fetal diarrhea
 - NE (weakness), NN (slow Cr drop), NG (dsymotility)
- 24 day hospital stay

Case 4

Cr	9.4 mg/dl
BUN	24 mg/dl
HCO ₃	39.1 mmol/l
Na	137 mmol/l
K	2.73 mmol/l
Cl	102 mmol/l
Ca ⁺⁺	4.62 mg/dl
Mg ⁺⁺	1.03 mg/dl
Lac	1.3 mmol/l
PO ₄	6.75 mg/dl
Alb	1.82 g/dl
Glob	2.48 g/dl

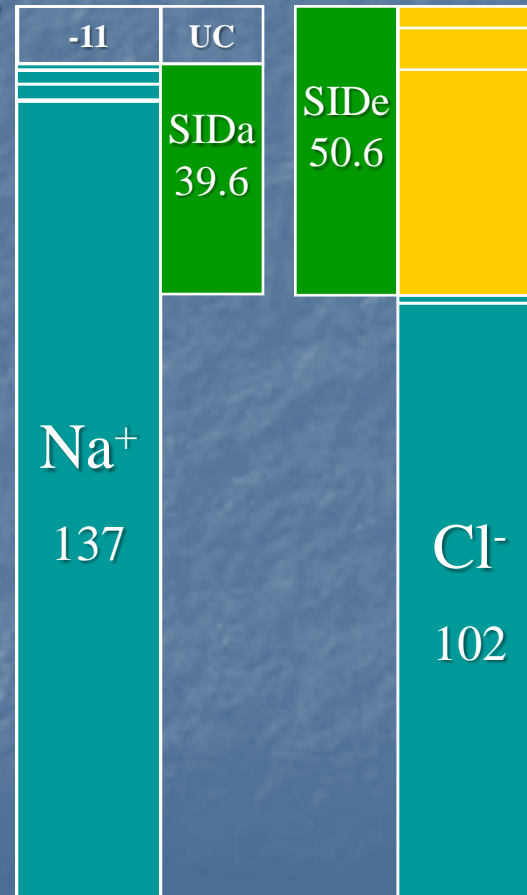


Case 4

UC

		mEq/l
pH	7.361	
Pco ₂	68.3	
HCO ₃	39.1 mmol/l	39.1
SBE	11.6	11.6
Na	137 mmol/l	137
K	2.73 mmol/l	2.73
Cl	102 mmol/l	102
Ca ⁺⁺	4.62 mg/dl	2.31
Mg ⁺⁺	1.03 mg/dl	0.84
Lac	1.3 mmol/l	1.3
PO ₄	6.75 mg/dl	3.98
Alb	1.82 g/dl	4.1
Glob	2.48 g/dl	3.5

Mg⁺⁺ = 1.05
 Ca⁺⁺ = 2.31
 K⁺ = 2.73



PO₄⁻ = 3.94
 Alb⁻+Glob⁻ = 7.6
 HCO₃⁻ = 39.1
 Lac⁻ = 1.3

Case 5

- 45 min TB colt
- History
 - Mare found passing fetal fluids
 - Eventration of intestines through vagina
 - Dystocia
 - Foal not breathing
 - 3-4 min ventilation
 - Spontaneous breathing, became active.
- Problems
 - Intrauterine challenge
 - Fractured ribs
 - Neonatal Encephalopathy
 - Neonatal Vasogenic Nephropathy
 - Necrotizing enterocolitis
- Outcome – euthanized at 48 hr
 - Fractured ribs (8 lt side)
 - NEC (reflux, feeding intolerance)
 - Renal disease

Case 5

Cr	16.8 mg/dl
BUN	22 mg/dl
HCO ₃	14 mmol/l
Na	135 mmol/l
K	4.23 mmol/l
Cl	81 mmol/l
Ca ⁺⁺	4.23 mg/dl
Mg ⁺⁺	1.23 mg/dl
Lac	18.6 mmol/l
PO ₄	20.5 mg/dl
Alb	2.89 g/dl
Glob	1.71 g/dl



Case 5

UA

		mEq/l
pH	7.088	
Pco ₂	45.9	
HCO ₃	14 mmol/l	14
SBE	-15.2 mEq/l	-15.2
Na	135 mmol/l	135
K	4.23 mmol/l	4.23
Cl	81 mmol/l	81
Ca ⁺⁺	4.23 mg/dl	2.12
Mg ⁺⁺	1.23 mg/dl	1.06
Lac	18.6 mmol/l	18.6
PO ₄	20.5 mg/dl	12.1
Alb	2.89 g/dl	6.5
Glob	1.71 g/dl	2.4

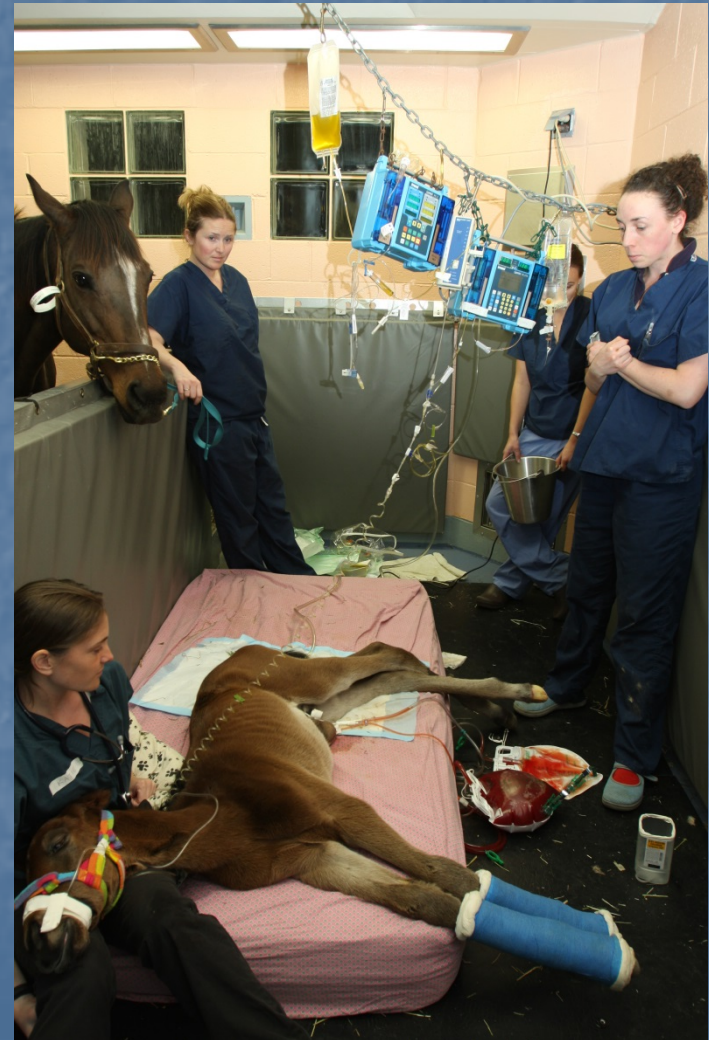
Mg⁺⁺ = 1.06
 Ca⁺⁺ = 2.12
 K⁺ = 4.23



PO₄⁻ = 12.1
 Alb⁻ + Glob⁻ = 8.9
 HCO₃⁻ = 14

Case 6

- 5.5 hr TB colt
- History
 - Unremarkable birth
 - Weakness from birth
 - Unable to rise unassisted
 - Large umbilical hernia
- Problems
 - Fractured ribs
 - Neonatal Encephalopathy, FIRS
 - Urinary
 - NN
 - Patent urachus
 - Urachal tear – uroperitoneum
 - Megacystis
 - Other
 - Entropion, pastern contracture, colic
- 8 day hospital stay



Case 6

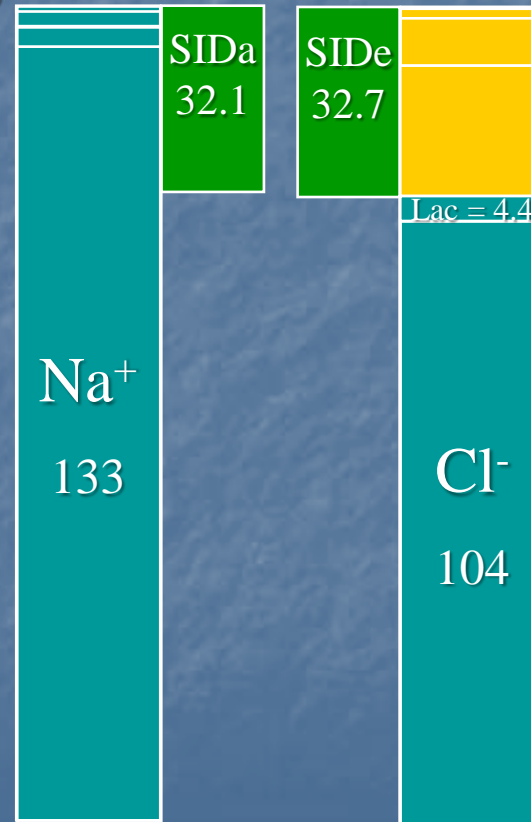
Cr	12.3 mg/dl
BUN	28
HCO ₃	22.5 mmol/L
Na	133 mmol/L
K	3.21 mmol/L
Cl	104 mmol/L
Ca ⁺⁺	6.72 mg/dl
Mg ⁺⁺	1.16 mg/dl
Lac	4.4 mmol/L
PO ₄	2.74 mg/dl
Alb	2.41 g/dl
Glob	2.29 g/dl



Case 6

		mEq/l
pH	7.329	
Pco ₂	42.5	
HCO ₃	22.5 mmol/L	
SBE	-2.9	
Na	133 mmol/L	133
K	3.21 mmol/L	3.21
Cl	104 mmol/L	104
Ca ⁺⁺	6.72 mg/dl	3.36
Mg ⁺⁺	1.16 mg/dl	0.96
Lac	4.4 mmol/L	4.4
PO ₄	2.74 mg/dl	1.62
Alb	2.41 g/dl	5.42
Glob	2.29 g/dl	3.3

Mg⁺⁺ = 0.96
 Ca⁺⁺ = 3.36
 K⁺ = 3.21



PO₄⁻ = 1.62
 Alb⁻ + Glob⁻ = 8.7
 HCO₃⁻ = 22.5

Case 7

- 20 hr old TB filly
- History
 - Evidence of significant umbilical bleeding
 - Down, cold, lethargic, pale
 - HR 80
 - Rx 500 ml whole blood from mare, fluids, dextrose
 - 'Perked up'
 - But some bleeding – unsuccessful suture/clamp artery
 - Nursing?
 - Fade again
 - Referred for blood transfusion
- Problems
 - Umbilical remnant hematoma
 - NE, anemia (20%), sepsis, NN, hepatopathy, NG, contracture
- 10 day hospital course

Case 7

Cr	1.7 mg/dl
BUN	11 mg/dl
HCO ₃	34 mmol/L
Na	132 mmol/L
K	3.62 mmol/L
Cl	99 mmol/L
Ca ⁺⁺	3.78 mg/dl
Mg ⁺⁺	0.90 mg/dl
Lac	0.9 mmol/L
PO ₄	3.37 mg/dl
Alb	2.01 g/dl
Glob	2.39 g/dl

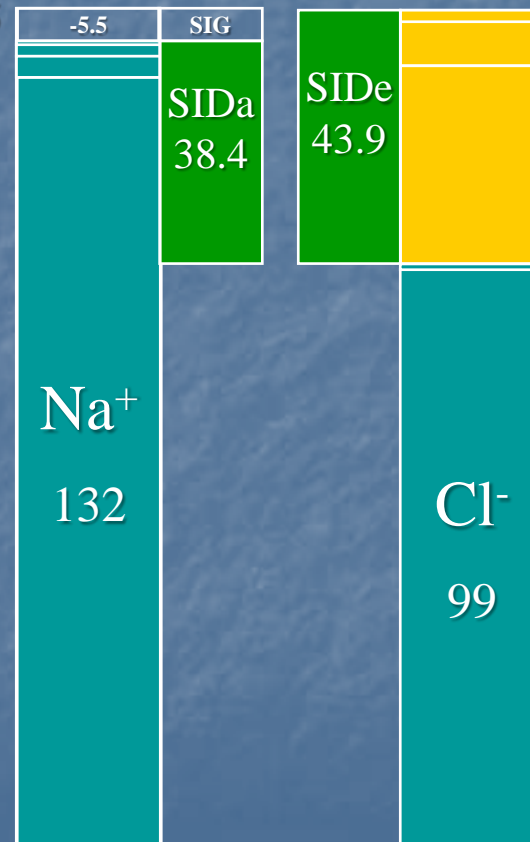


Case 7

UA

		mEq/l
pH	7.455	
Pco ₂	48.6	
HCO ₃	34 mmol/L	34
SBE	10.3	10.3
Na	132 mmol/L	132
K	3.62 mmol/L	3.62
Cl	99 mmol/L	99
Ca ⁺⁺	3.78 mg/dl	1.89
Mg ⁺⁺	0.90 mg/dl	0.75
Lac	0.9 mmol/L	0.9
PO ₄	3.37 mg/dl	1.99
Alb	2.01 g/dl	4.52
Glob	2.39 g/dl	3.3

Mg⁺⁺ = 0.75
 Ca⁺⁺ = 1.98
 K⁺ = 3.62



PO₄⁻ = 1.99
 Alb⁻ + Glob⁻ = 7.8
 HCO₃⁻ = 34
 Lac = 0.9

Case 7



Case 8

- 3 day old TB filly
- History
 - Never vigorous
 - Contracted left hind
 - Diarrhea 12 hr
 - Colicky, abdominal distention
 - Free fluid in abdomen - ruptured bladder?
- Problem: enteritis

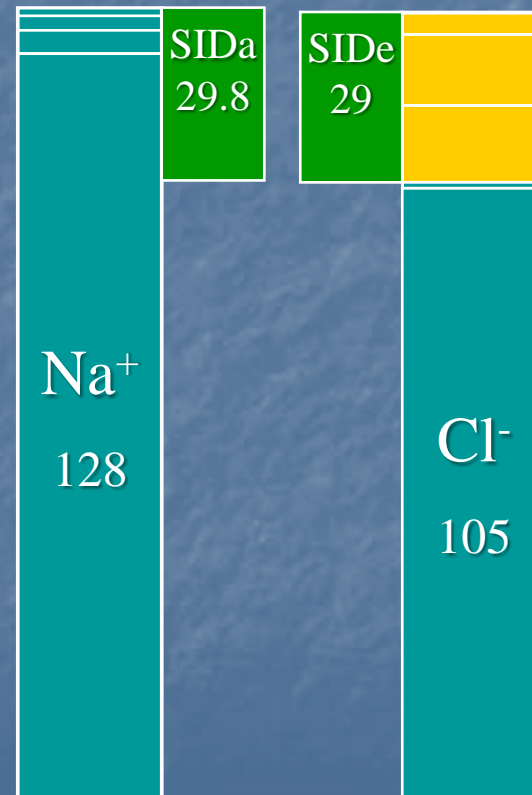
Case 8

Cr	1.5 mg/dl
BUN	15 mg/dl
HCO ₃	13.1 mmol/L
Na	128 mmol/L
K	3.93 mmol/L
Cl	105 mmol/L
Ca ⁺⁺	5.53 mg/dl
Mg ⁺⁺	1.51 mg/dl
Lac	1.1 mmol/L
PO ₄	6.06 mg/dl
Alb	2.76 g/dl
Glob	4.34 g/dl

Case 8

		mEq/l
pH	7.239	
Pco ₂	31.2	
HCO ₃	13.1 mmol/L	13.1
SBE	-12.2	-12.2
Na	128 mmol/L	128
K	3.93 mmol/L	3.93
Cl	105 mmol/L	105
Ca ⁺⁺	5.53 mg/dl	2.77
Mg ⁺⁺	1.51 mg/dl	1.25
Lac	1.1 mmol/L	1.1
PO ₄	6.06 mg/dl	3.58
Alb	2.76 g/dl	6.21
Glob	4.34 g/dl	6.1

Mg⁺⁺ = 1.25
 Ca⁺⁺ = 2.77
 K⁺ = 3.93



PO₄⁻ = 3.58
 Alb⁻ + Glob⁻ = 12.3
 HCO₃⁻ = 13.1
 Lac = 1.1

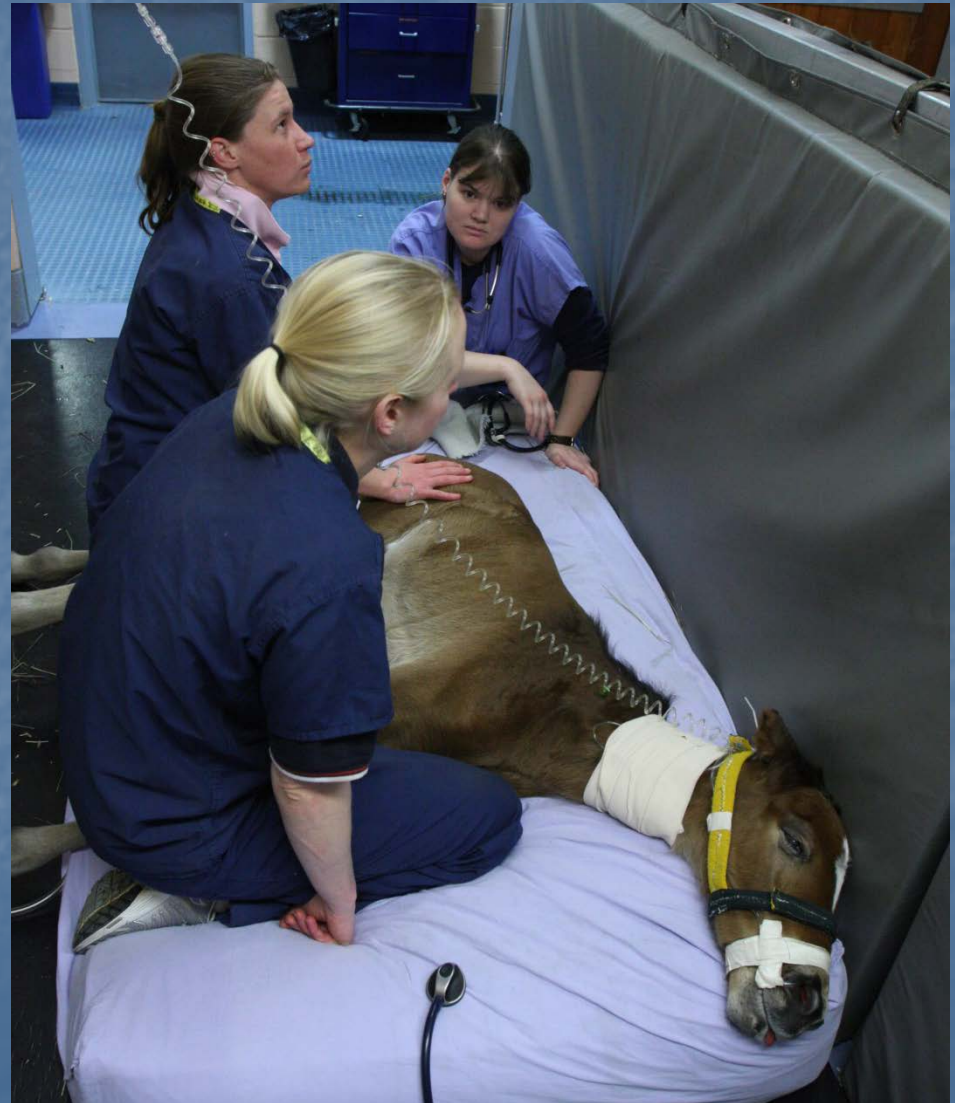
Case 9

- 30 min old TB colt
- History
 - Premature placental separation
 - Upper airway obstruction
- Problems
 - Respiratory distress
 - Pharyngeal collapse
 - Central Tachypnea
 - NE, NG, NN, Shock
 - Respiratory failure
 - Anuria
- Euthanized 48 hr



Case 9

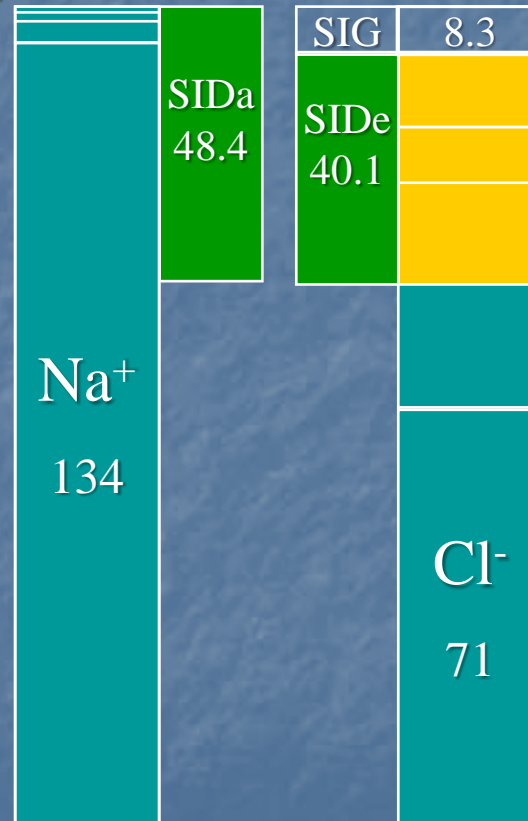
Cr	27.5 mg/dl
BUN	16 mg/dl
HCO ₃	17.6 mmol/L
Na	134 mmol/L
K	3.52 mmol/L
Cl	71 mmol/L
Ca ⁺⁺	4.01 mg/dl
Mg ⁺⁺	1.01 mg/dl
Lac	21 mmol/L
PO ₄	21.7 mg/dl
Alb	3.18 g/dl
Glob	1.82 g/dl



Case 9

		mEq/l
pH	7.084	
Pco ₂	58	
HCO ₃	17.6 mmol/L	17.6
SBE	-12.5	-12.4
Na	134 mmol/L	134
K	3.52 mmol/L	3.52
Cl	71 mmol/L	71
Ca ⁺⁺	4.01 mg/dl	2.01
Mg ⁺⁺	1.01 mg/dl	0.84
Lac	21 mmol/L	21
PO ₄	21.7 mg/dl	12.8
Alb	3.18 g/dl	7.16
Glob	1.82 g/dl	2.5

Mg⁺⁺ = 0.84
 Ca⁺⁺ = 2.01
 K⁺ = 3.52



PO₄⁻ = 12.8
 Alb⁻ + Glob⁻ = 9.66
 HCO₃⁻ = 17.6
 Lac = 21

