Recognizing and Managing the Unstable Overdose Patient

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Disclosures

None

HR 121
BP 131/90
T 37.9
RR 28
SpO2 93%

Drowsy
Confused
Vomiting
Rales

Test Name	Lab Results
pH, Venous	**7.44**
pCO2, Venous	**27**
pO2, Venous	81
HCO3-	**18**
Lactate	**4.1**

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pH, Venous	**7.44**	
pCO2, Venous	**27**	!
pO2, Venous	81	
HCO3-	**18**	!
Lactate	**4.1**	!

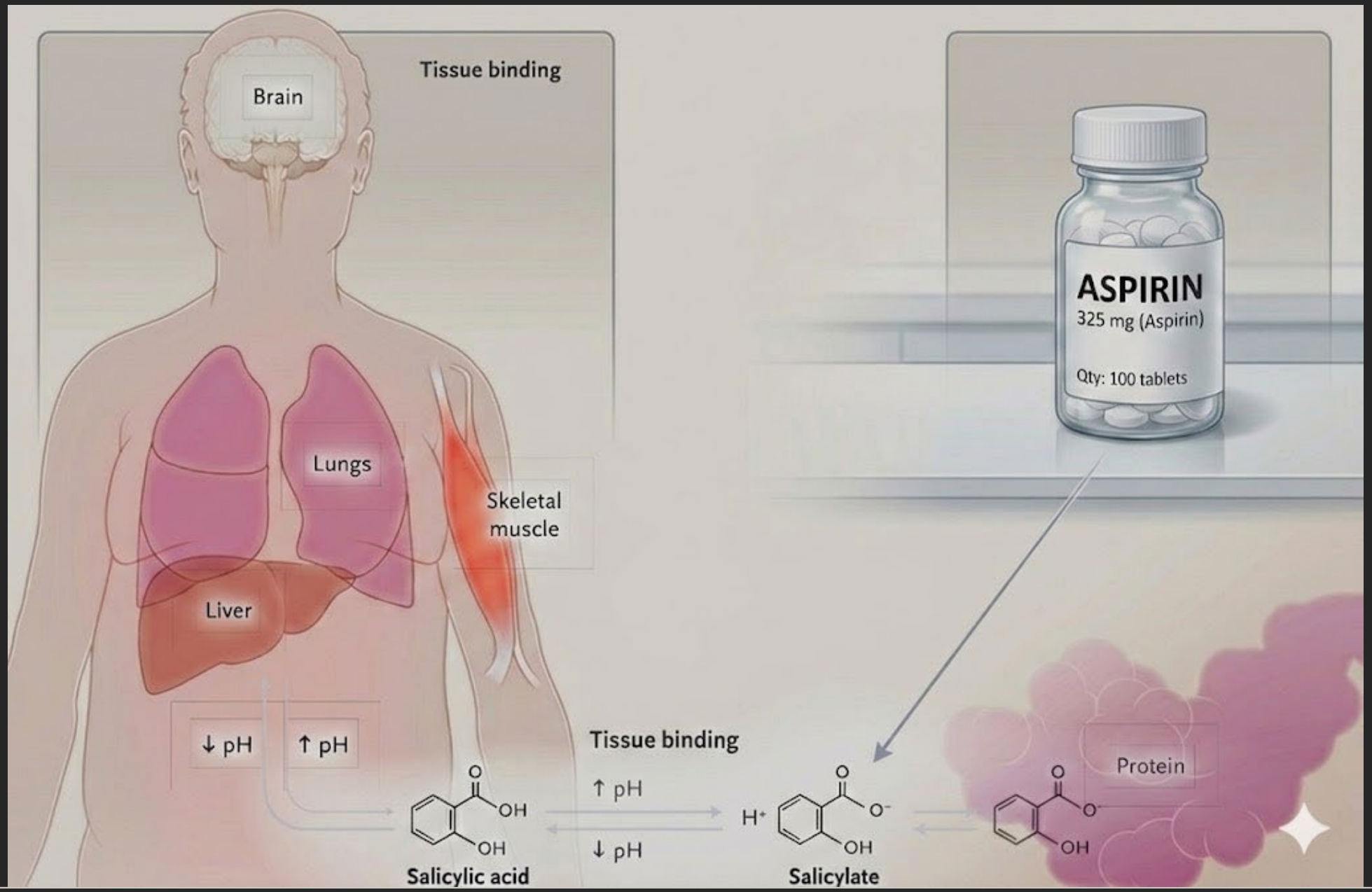
Basic Metabolic Panel (BMP)

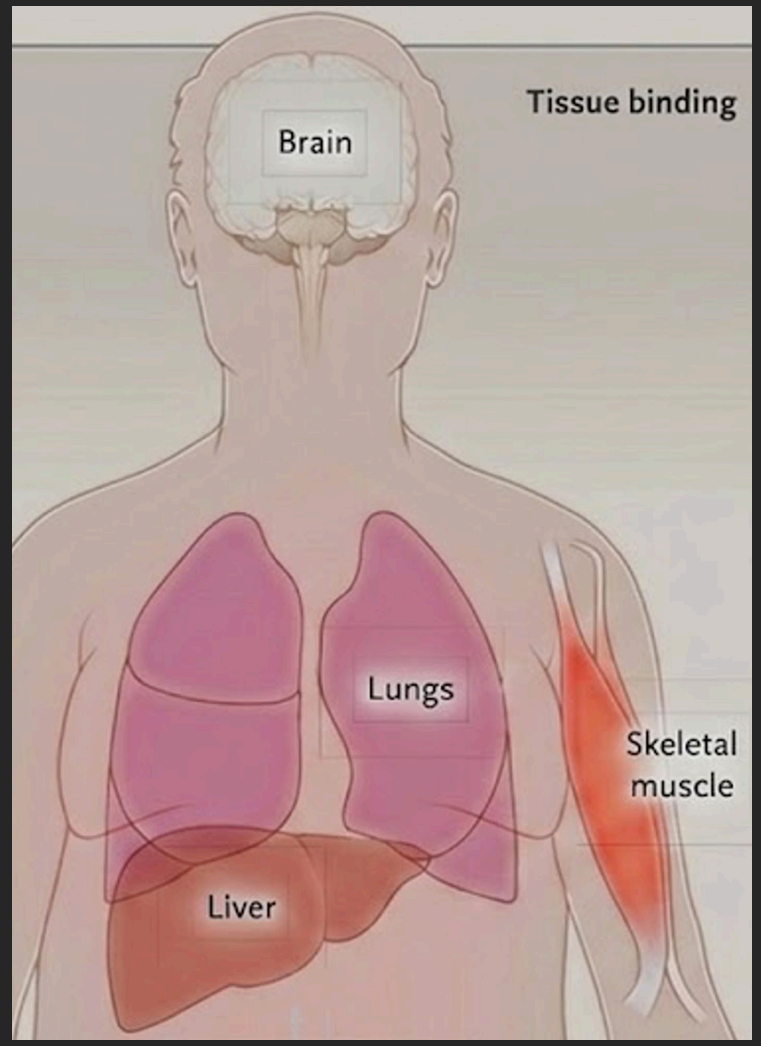
Test Name	Lab Results	
Sodium, Serum	**138**	
Chloride, Serum	**109**	H
Potassium, Serum	**3.6**	
Bicarbonate (CO2), Serum	**17**	!
Anion Gap	**22**	!
BUN	**18**	
Glucose, Serum	**94**	
Creatinine, Serum	**1.2**	

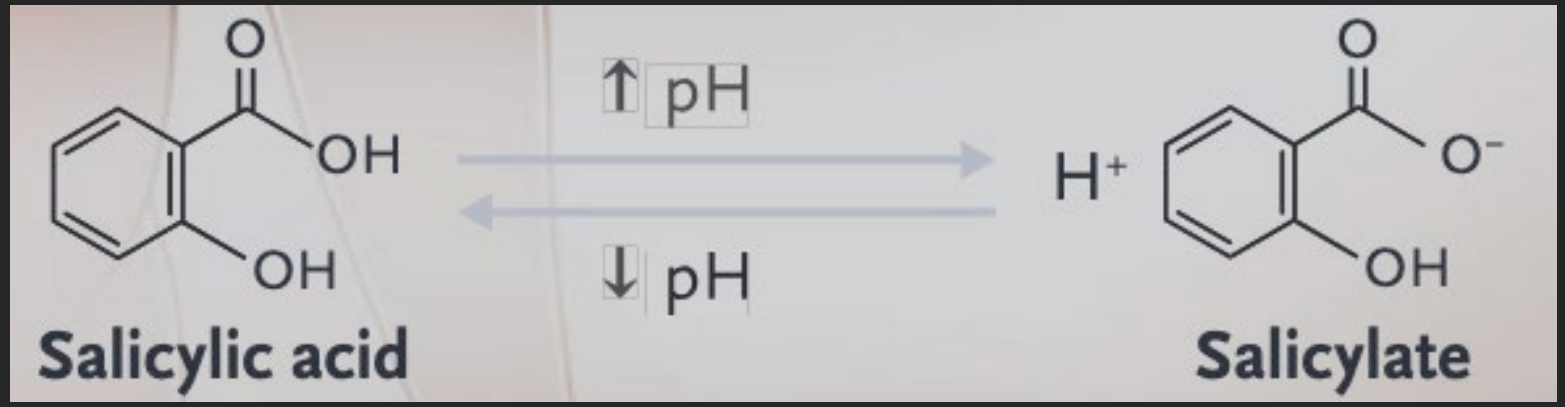
Diagnosis?

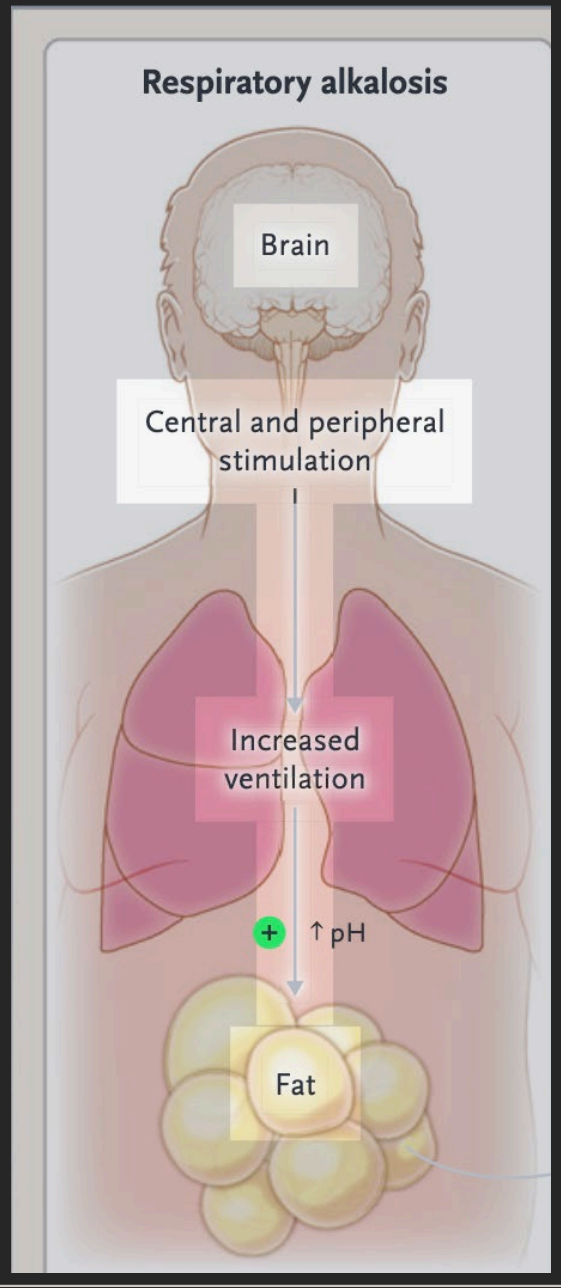
- Sepsis?
- Euglycemic DKA?
- Pneumonia?
- Encephalitis?

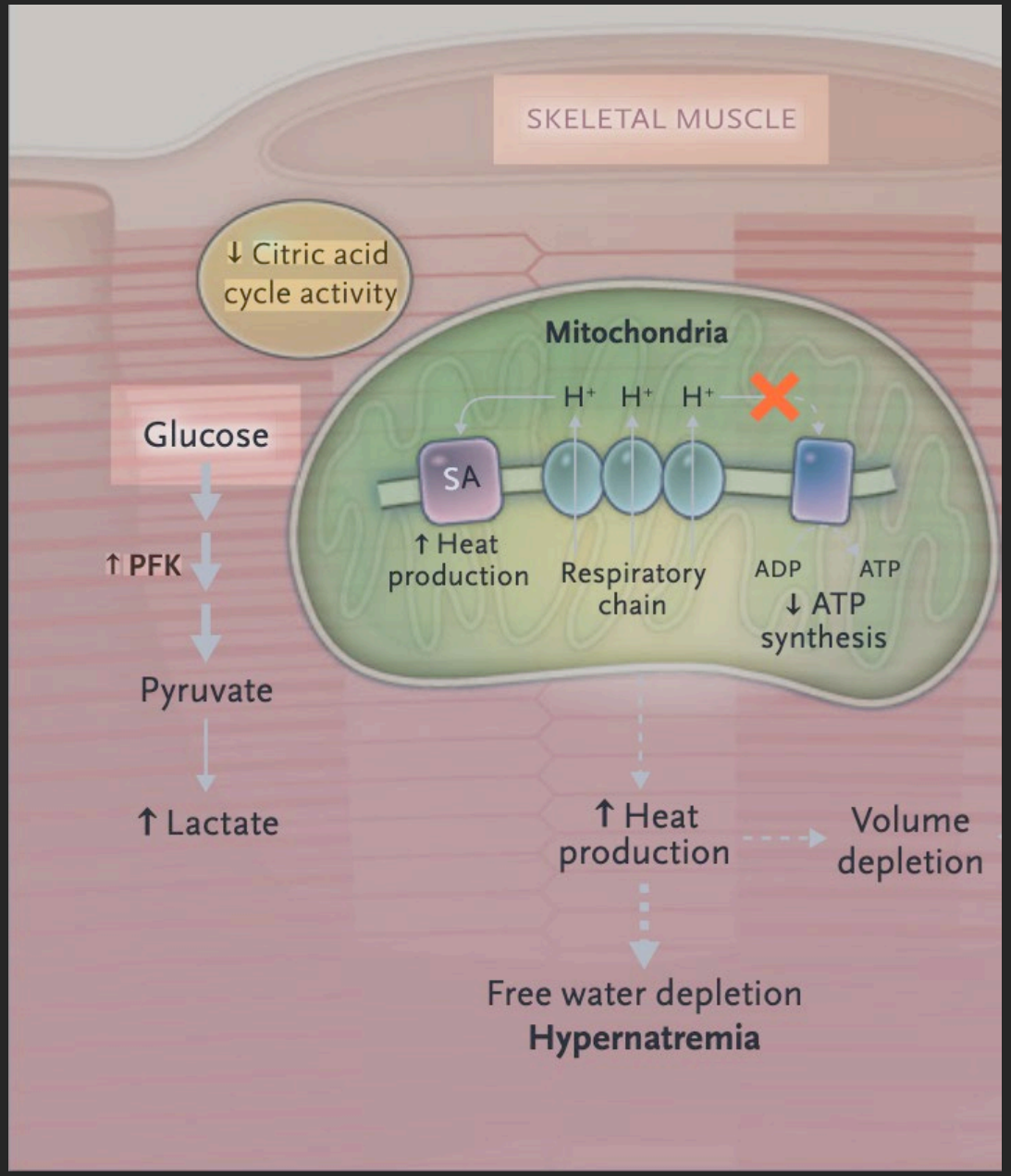
Salicylate, Serum: **61** mg/dL !

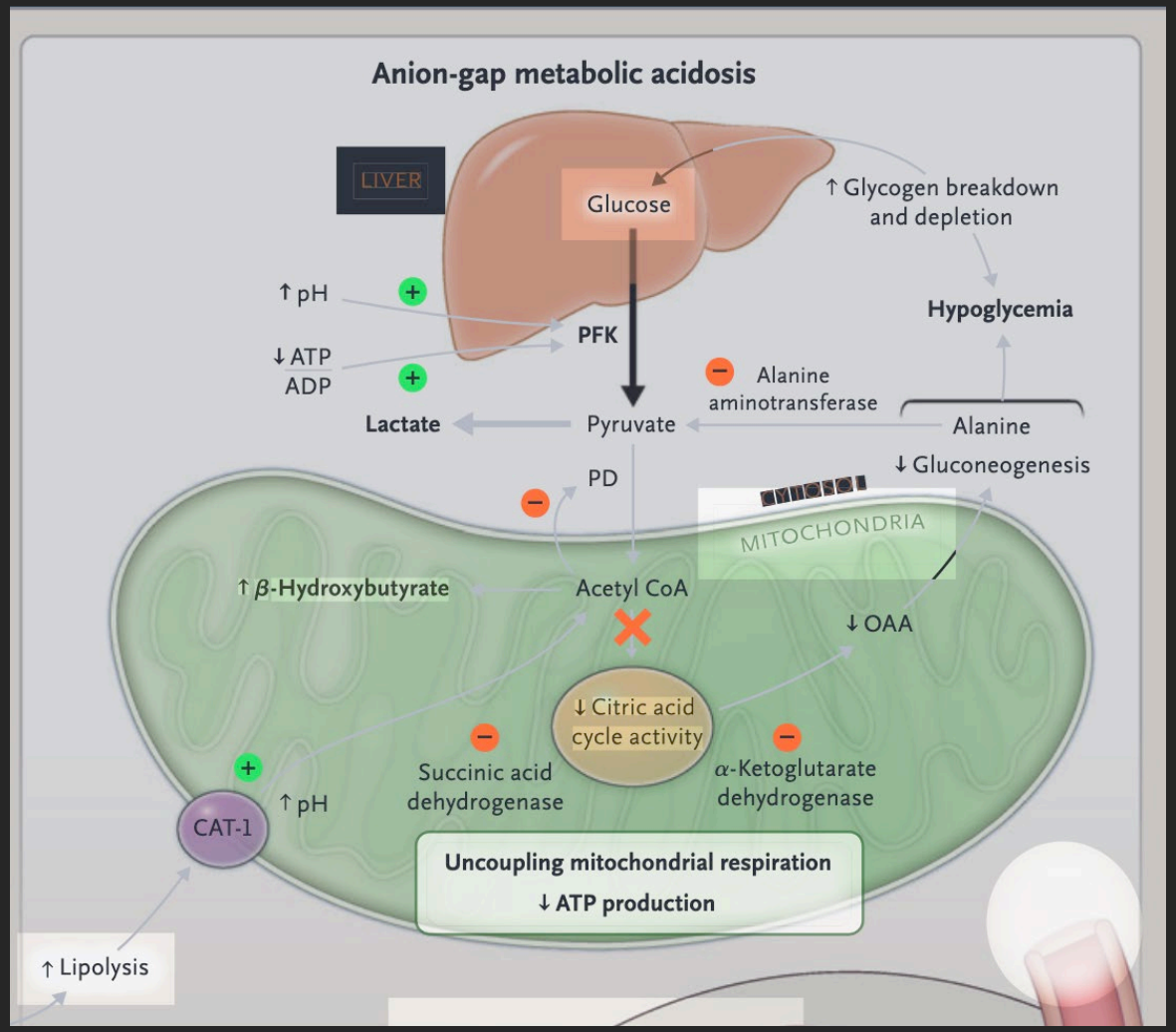

Tissue binding
Brain
Lungs
Skeletal muscle
Liver
↓ pH
↑ pH
ASPIRIN
325 mg (Aspirin)
Qty: 100 tablets
Tissue binding
↑ pH
↓ pH
Salicylic acid
Salicylate
Protein

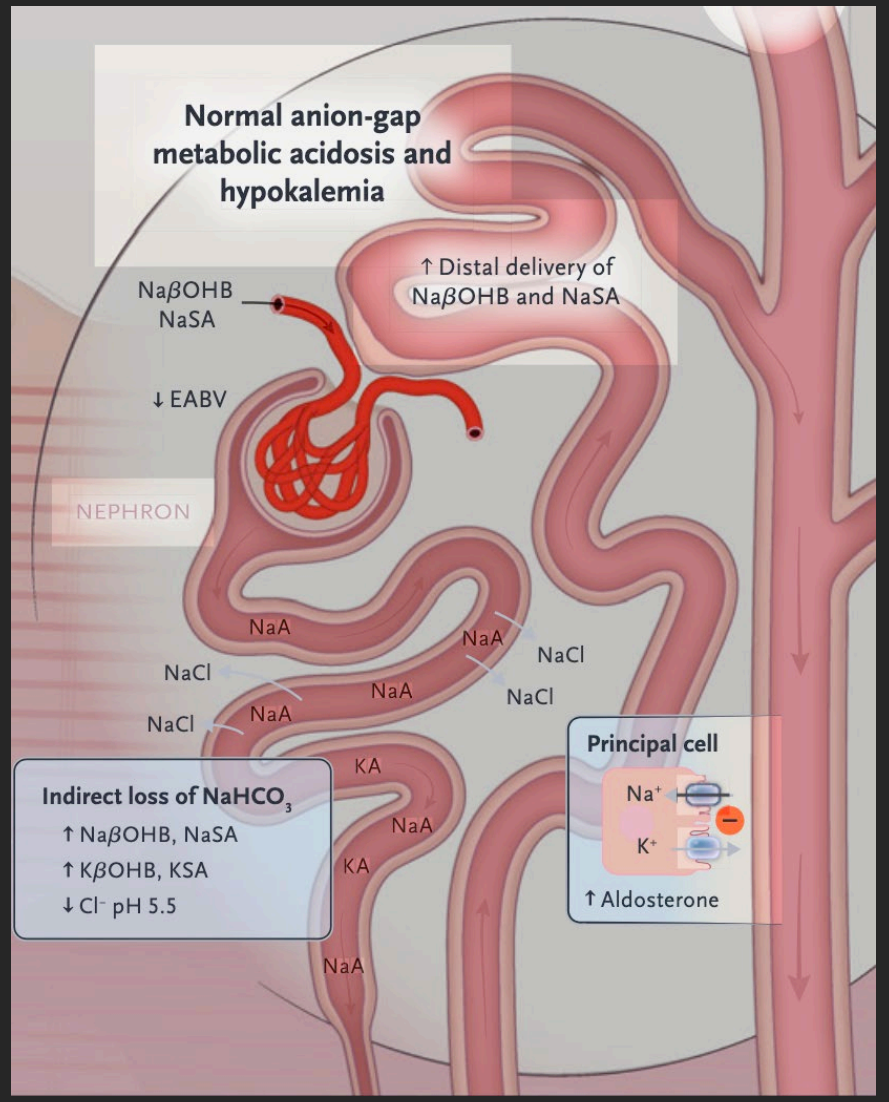

Tissue binding
Brain
Lungs
Skeletal muscle
Liver


O
OH
OH
↑ pH
↓ pH
H+
O⁻
OH
Salicylic acid
Salicylate


Respiratory alkalosis
Brain
Central and peripheral stimulation
Increased ventilation
↑ pH
Fat


SKELETAL MUSCLE
↓ Citric acid cycle activity
Mitochondria
H+ H+ H+
Glucose
SA
↑ Heat production
Respiratory chain
ADP ATP
↓ ATP synthesis
↑ PFK
Pyruvate
↑ Lactate
↑ Heat production
Volume depletion
Free water depletion
Hypernatremia


Anion-gap metabolic acidosis
LIVER
Glucose
↑ Glycogen breakdown and depletion
Hypoglycemia
↑ pH
↓ ATP
ADP
PFK
Alanine aminotransferase
Lactate
Pyruvate
Alanine
↓ Gluconeogenesis
PD
MITOCHONDRIA
↑ β-Hydroxybutyrate
Acetyl CoA
↓ OAA
↓ Citric acid cycle activity
Succinic acid dehydrogenase
α-Ketoglutarate dehydrogenase
↑ pH
CAT-1
Uncoupling mitochondrial respiration
↓ ATP production
↑ Lipolysis


Normal anion-gap metabolic acidosis and hypokalemia
↑ Distal delivery of NaβOHB and NaSA
NaβOHB
NaSA
↓ EABV
NEPHRON
NaA
NaCl
KA
Indirect loss of NaHCO3
↑ NaβOHB, NaSA
↑ KβOHB, KSA
↓ Cl⁻ pH 5.5
Principal cell
Na+
K+
↑ Aldosterone

Make the diagnosis!

27% of chronic salicylate overdoses are missed in ER

3.5% of patients who develop treatable ASA levels (>30 mg/dL) have initially undetectable levels

Make the diagnosis!

Test Name	Lab Results	
pH, Venous	**7.44**	
pCO2, Venous	**27**	!
pO2, Venous	81	
HCO3-	**18**	!
Lactate	**4.1**	!

Basic Metabolic Panel (BMP)

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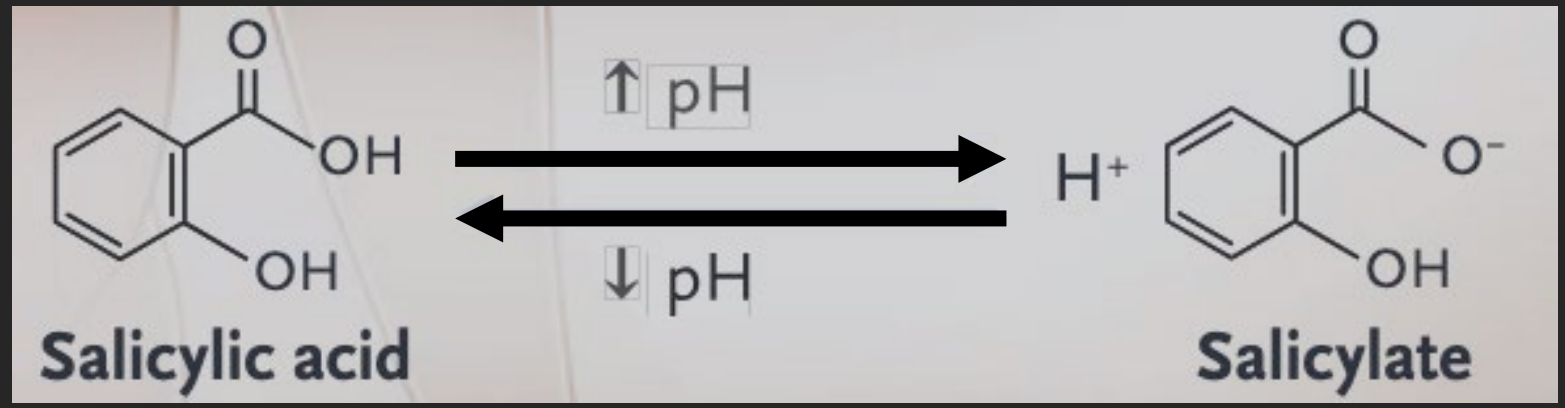
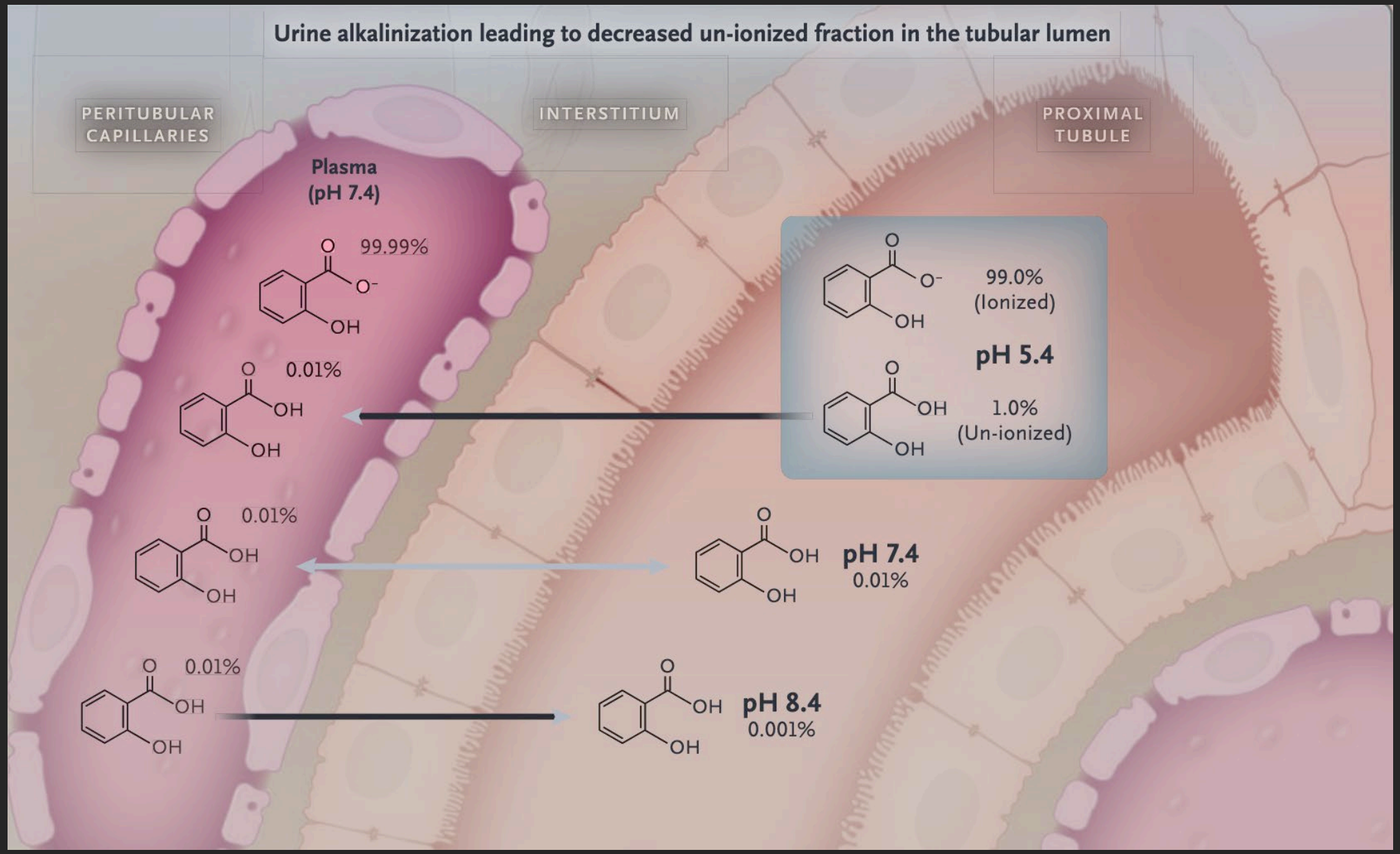
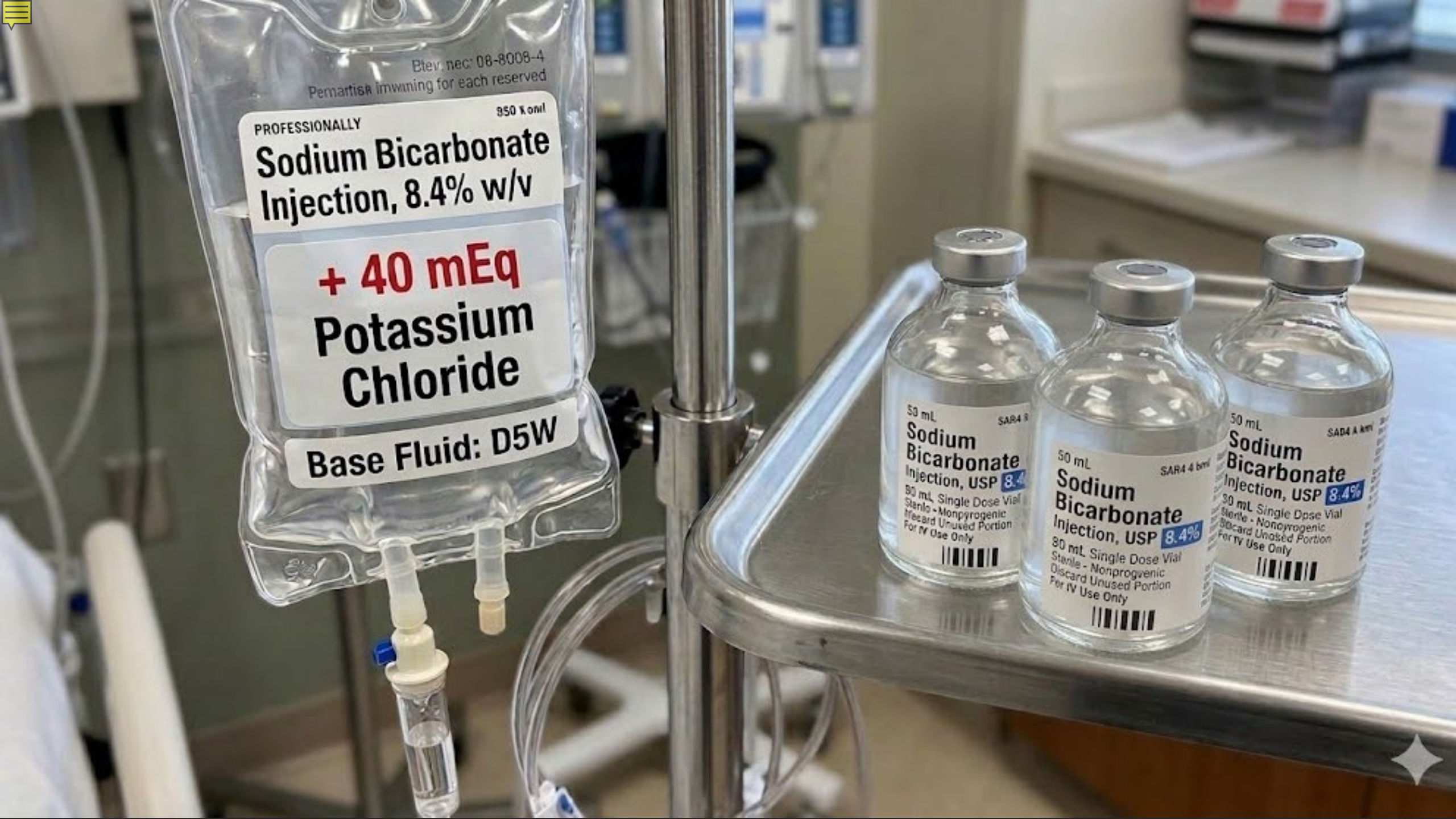
Anion Gap	**22**	!
BUN	**18**	
Glucose, Serum	**94**	
Creatinine, Serum	**1.2**	

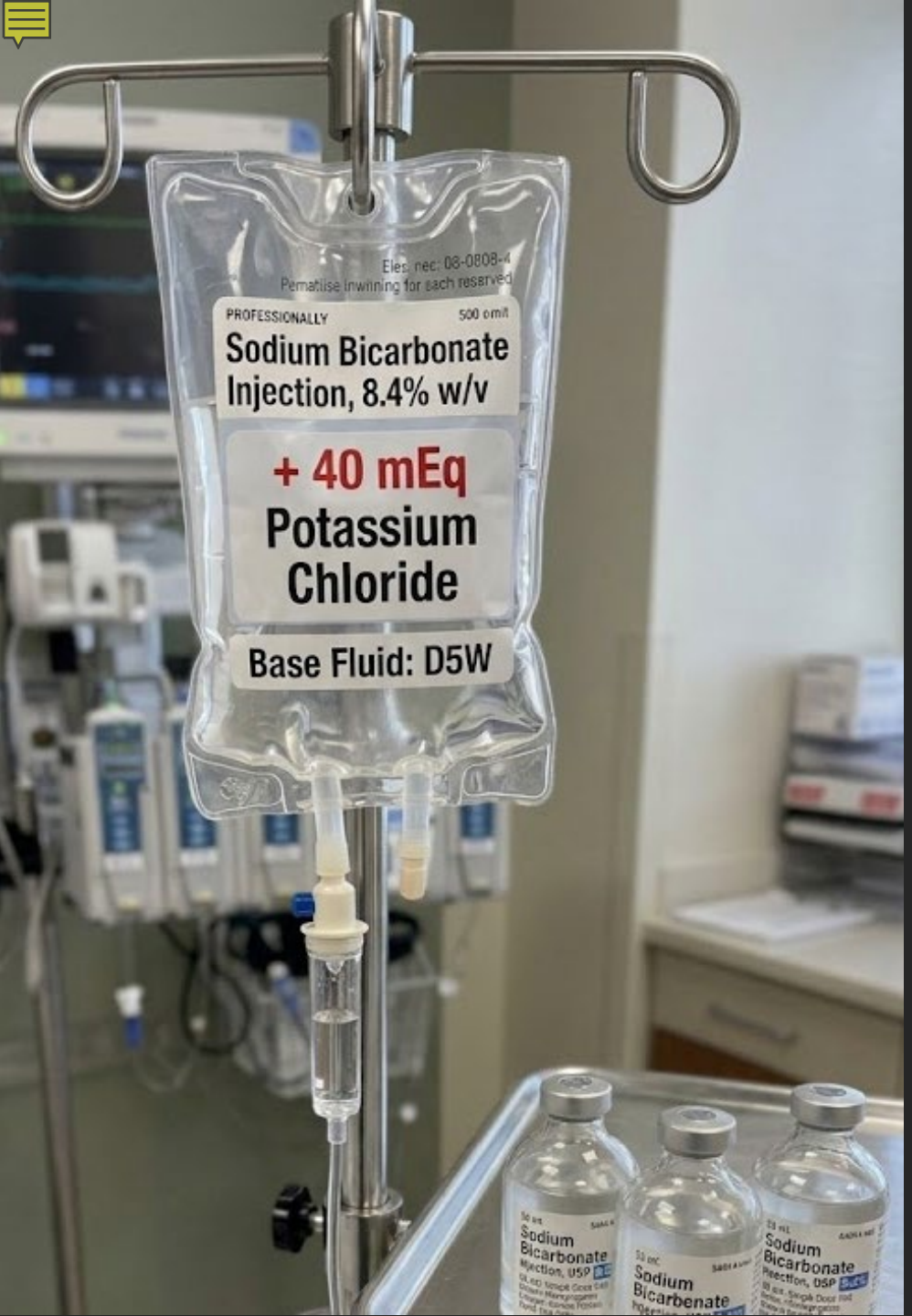
Make the diagnosis!

- Toxic threshold **30 mg/dL**
  - Occasionally reported as 300 *mg/L*
  - or internationally 2.2 *mmol/L*


O
OH
OH
Salicylic acid
↑ pH
↓ pH
H+
O
O⁻
OH
Salicylate


Urine alkalinization leading to decreased un-ionized fraction in the tubular lumen
PERITUBULAR CAPILLARIES
INTERSTITIUM
PROXIMAL TUBULE
Plasma (pH 7.4)
99.99%
0.01%
99.0% (Ionized)
pH 5.4
1.0% (Un-ionized)
0.01%
pH 7.4
0.01%
0.01%
pH 8.4
0.001%

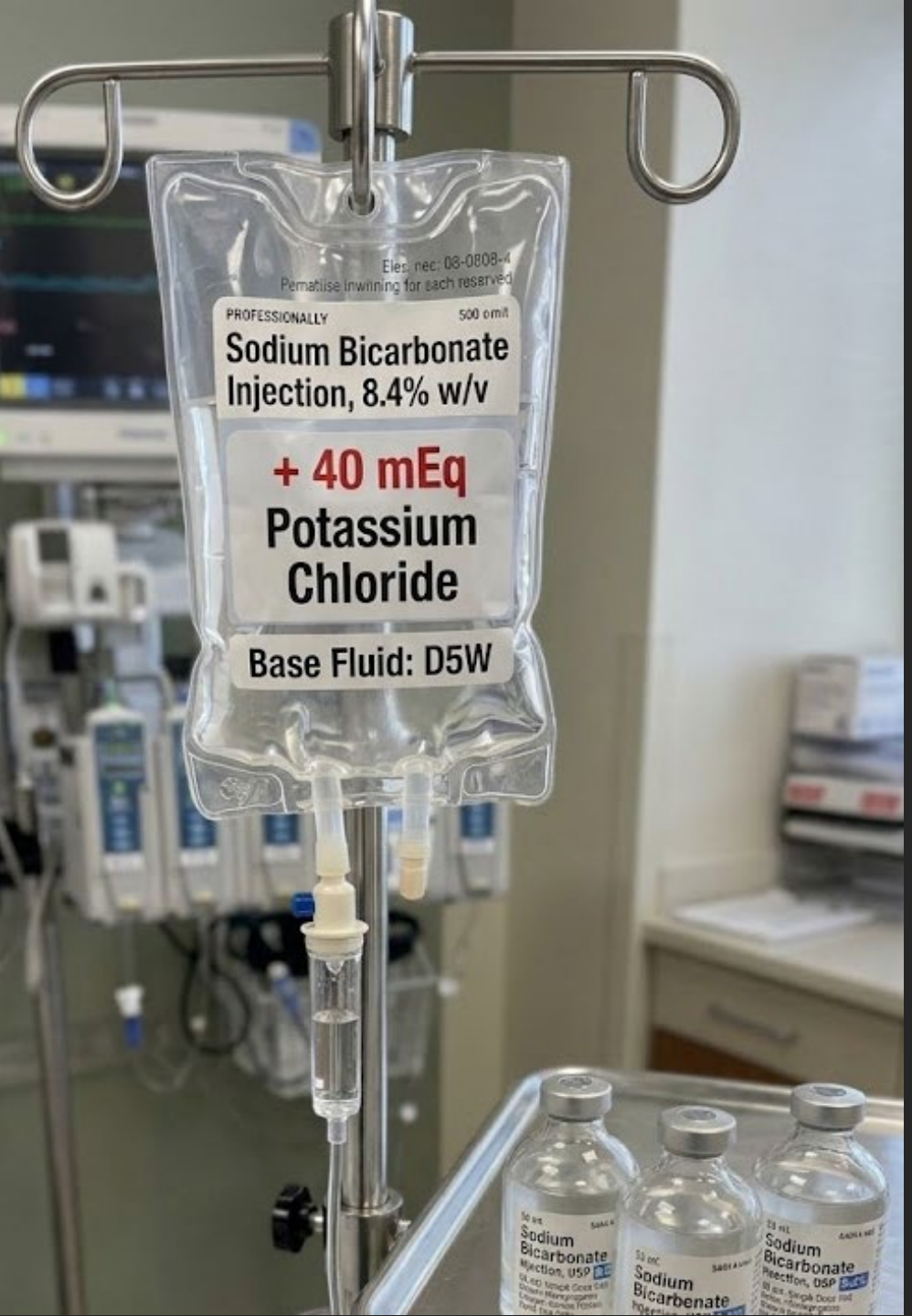

PROFESSIONALLY
Sodium Bicarbonate Injection, 8.4% w/v
+ 40 mEq
Potassium Chloride
Base Fluid: D5W
50 mL
Sodium Bicarbonate
Injection, USP 8.4%
50 mL Single Dose Vial
Sterile - Nonpyrogenic
Discard Unused Portion
For IV Use Only



3 amps bicarbonate (50 mEq each)

+ 40 mEq KCL

In 1L D5



200 mL/hour

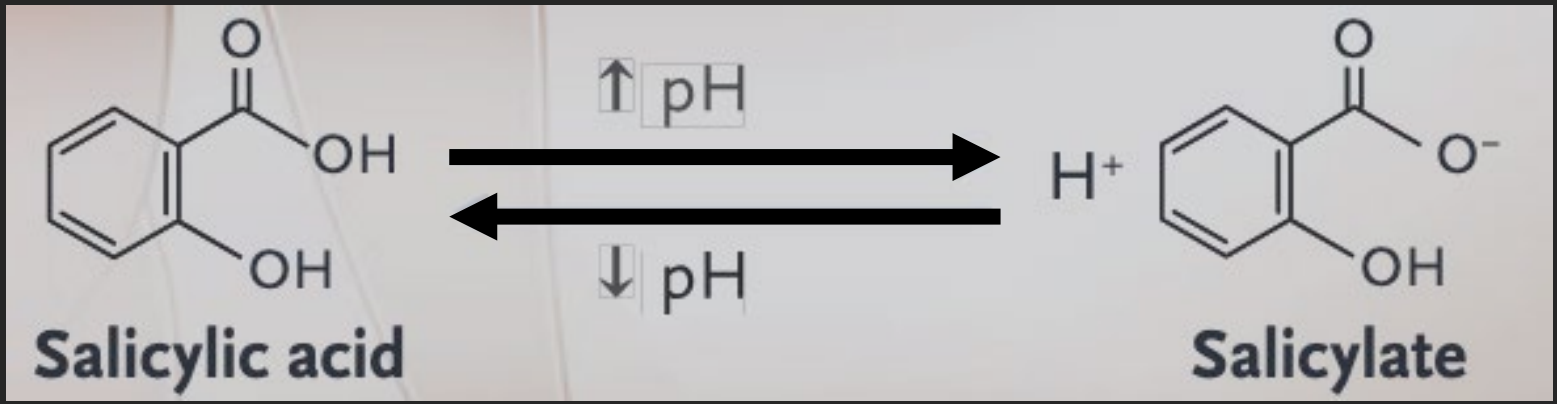
- higher if young, healthy kidneys
- lower if older, CKD, HF

Goal pH 7.50-7.55

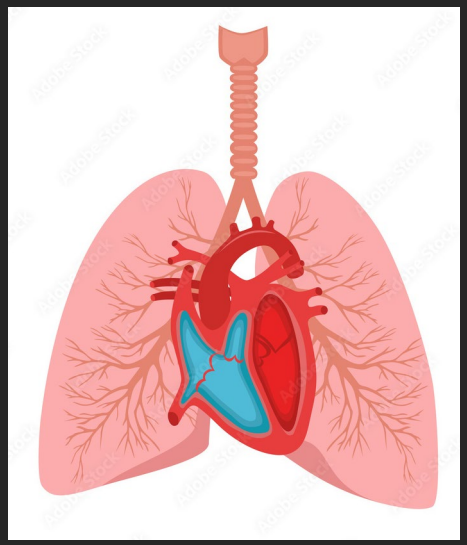
HR 128
BP 99/52
T 37.8
RR 31
SpO2 89%

Drowsy
Confused
Vomiting
Rales

Test Name	Lab Results
pH, Venous	**7.35**
pCO2, Venous	**31**
pO2, Venous	81
HCO3-	**15**
Lactate	**4.5**


O
OH
OH
↑ pH
↓ pH
H+
O
O⁻
OH
Salicylic acid
Salicylate

RR: 35
Vt: 15 ml/kg
MV: 36 L/min



RR: 40+
Vt: 30+ ml/kg
MV: 84+ L/min

BRIEF REPORT

doi: 10.1111/j.1553-2712.2008.00205.x

Mechanical Ventilation Was Associated with Acidemia in a Case Series of Salicylate-poisoned Patients

Andrew I. Stolbach, MD, Robert S. Hoffman, MD, Lewis S. Nelson, MD

Patient	Peak ASA Concentration (mg/dL)	pH	PCO_2 (mm Hg)	Comments
1				
Pre-MV	143	NA	NA	Good outcome—received HD, alkalinization, and pressors
Post-MV		7.35	16	
2				
Pre-MV	122	7.47	20	Good outcome-received peri-intubation HD
Post-MV		7.30	53	
3				
Pre-MV	85	NA	NA	Death; ventilatory rate at 14/min with tidal volume of 600 mL
Post-MV		7.14	69	
4				
Pre-MV	84	7.42	26	Very poor neurological outcome; HD
Post-MV		7.14	66	
5				
Pre-MV	79	NA	NA	Death
Post-MV		6.79	71	
6				
Pre-MV	74.5	7.4	NA	Good outcome
Post-MV		7.11	NA	
7				
Pre-MV	67	7.47	24.7	Good outcome; no HD
Post-MV		7.25	67	

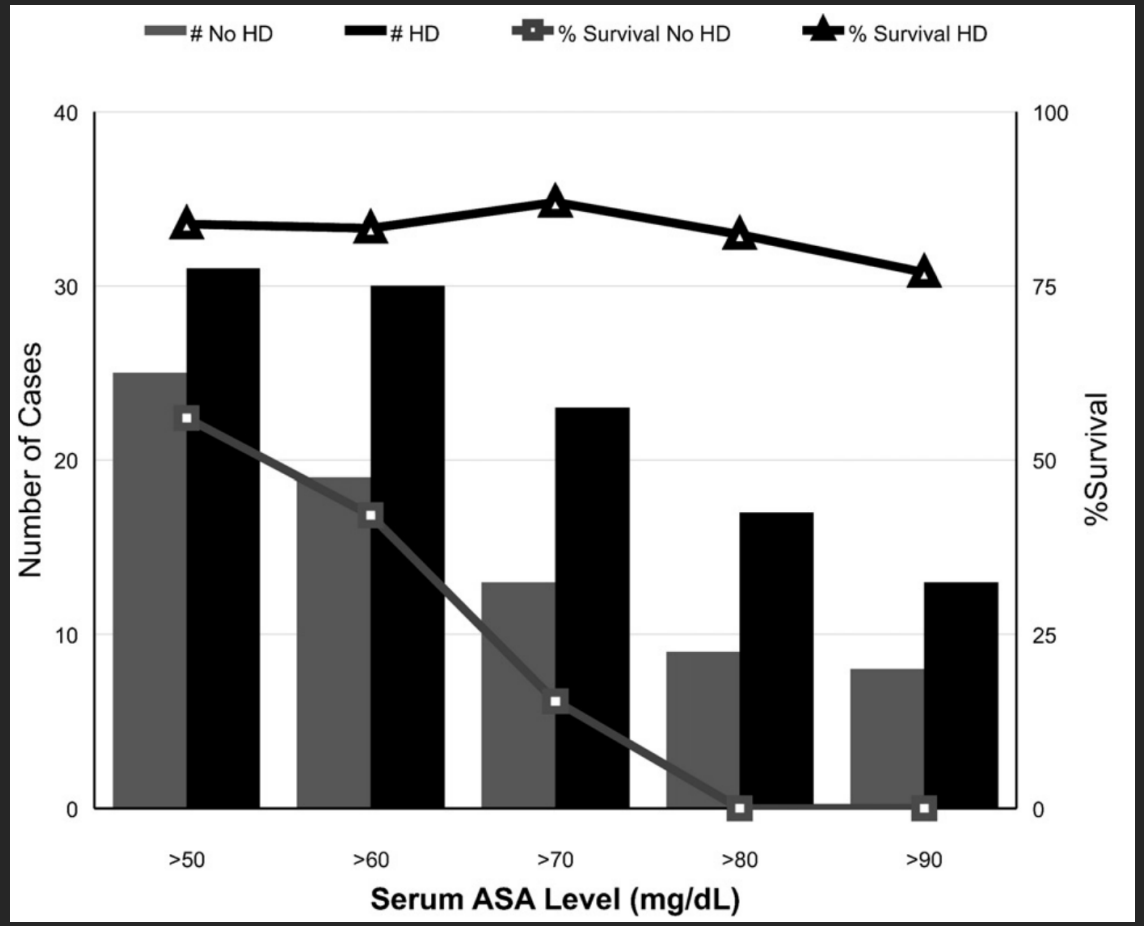
Original Contribution

American Journal of Emergency Medicine 35 (2017) 899–903

The association of hemodialysis and survival in intubated salicylate-poisoned patients

Daniel J. McCabe, MD [a,*], Jenny J. Lu, MD, MS [a,b]

[a] *Department of Emergency Medicine, Cook County Hospital, Chicago, IL 60612, United States*
[b] *Toxikon Consortium, Chicago, IL 60612, United States*



Do I have to intubate?

- Bolus bicarbonate before and after intubation
- No apnea
- Maximal minute ventilation
- HD ASAP
- Expect trouble

General Recommendation

- ECTR is recommended in severe salicylate poisoning (1D)

Indications

ECTR is recommended if ANY of the following are met:

- If [salicylate] > 7.2 mmol/L (100 mg/dL) (1D)
- If [salicylate] > 6.5 mmol/L (90 mg/dL) in the presence of impaired kidney function (1D)
- In the presence of altered mental status (1D)
- In the presence of new hypoxemia requiring supplemental oxygen (1D)
- If standard therapy (supportive measures, bicarbonate, etc.) fails (1D)

ECTR is suggested if ANY of the following are met:

- If [salicylate] > 6.5 mmol/L (90 mg/dL) (2D)
- If [salicylate] > 5.8 mmol/L (80 mg/dL) in the presence of impaired kidney function (2D)
- If the systemic pH is ≤ 7.20 (2D)

Don’t get too hung up on the level!

- In the presence of altered mental status (1D)
- In the presence of new hypoxemia requiring supplemental oxygen (1D)
- If standard therapy (supportive measures, bicarbonate, etc.) fails (1D)

HD > CRRT

Salicylates: Pearls & Pitfalls

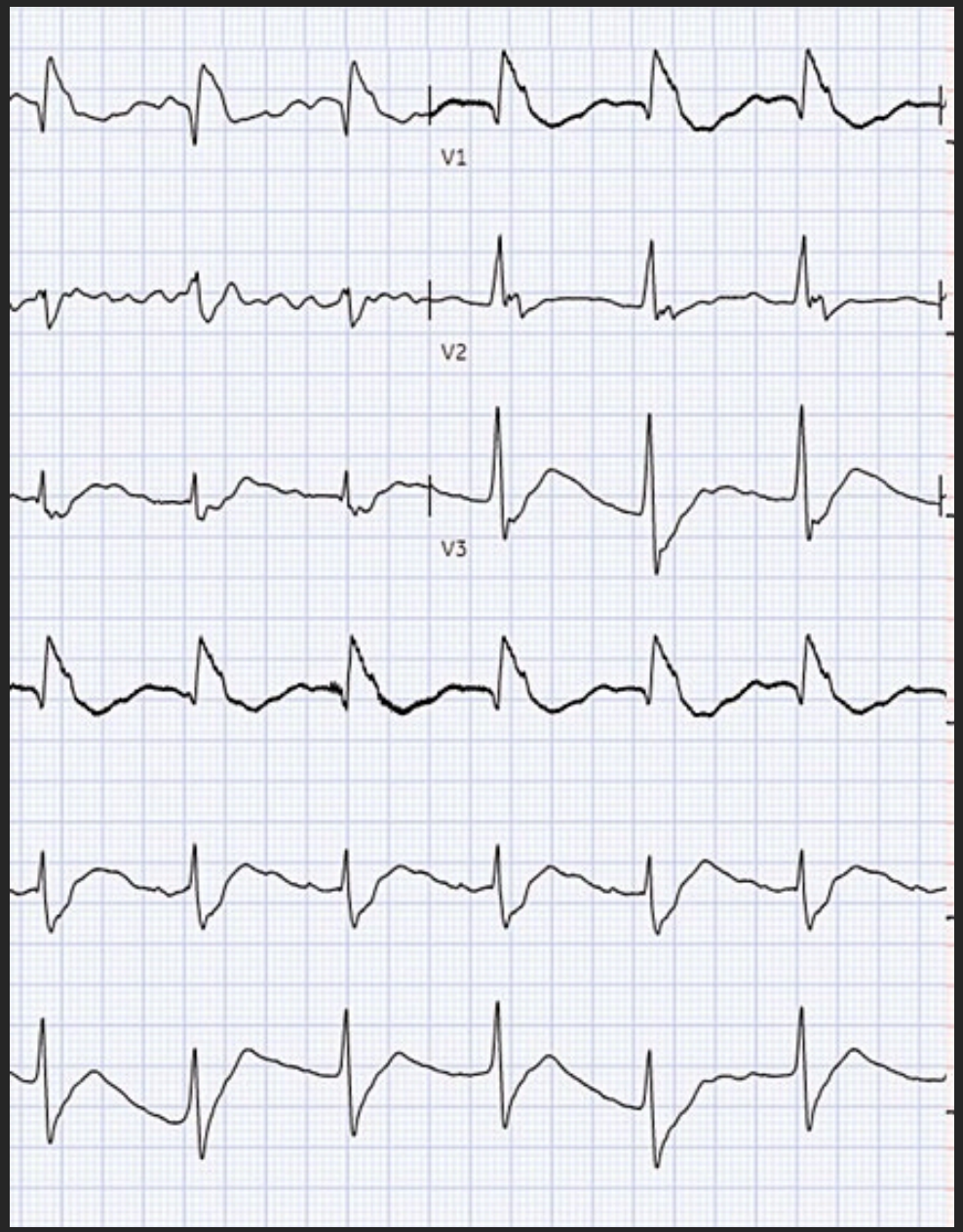
- Bicarbonate therapy increases clearance
- Hemodialysis clears salicylates more effectively than CRRT

- Don’t miss the diagnosis
- Don’t intubate until you are certain it is required
- Don’t get too hung up on the level

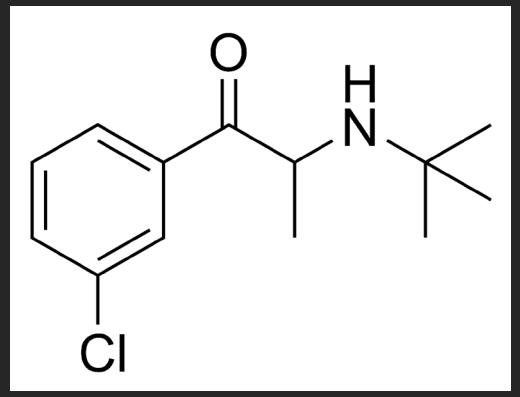
HR 77
BP 86/40
RR 19
SpO2 94%

Drowsy
Tremulous
Seizes

VBG pH 7.28
Lactate 3.5
ECG?


V1
V2
V3


PATIENT: MS WELLS
BUPROPION
300 MG XR
EXTENDED-RELEASE TABLETS
Rx #: 10345678 DATE: OCT 26, 2023
QTY: 30
DIRECTIONS: TAKE 1 TABLET BY MOUTH ONCE DAILY IN THE MORNING
PHARMACY:
ALAMEDA HEALTH PHARMACY
PATIENT: MS WELLS
PROPRANOLOL
10 MG
TABLETS
Rx #: 10345679
QTY: 60
DIRECTIONS: TAKE 1 TABLET BY MOUTH THREE TIMES DAILY AS NEEDED
PHARMACY:
ALAMEDA HEALTH PHARMACY



Bupropion

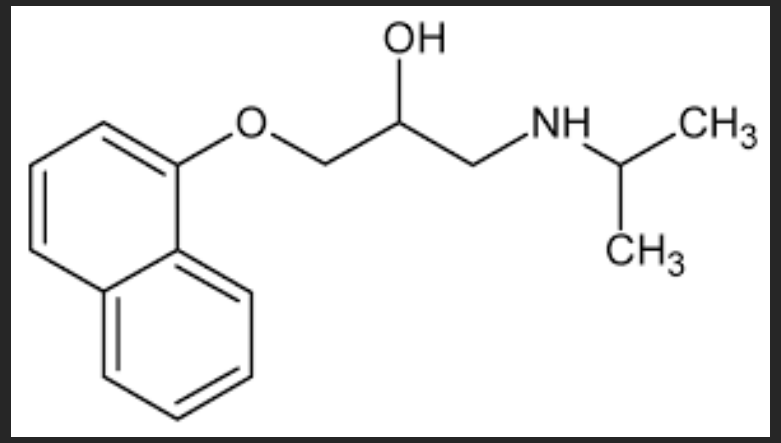
- Synthetic cathinone stimulant

  Agitation, tremor, sympathomimetic

  Seizures

- Wide QRS, prolonged QT

  Ventricular arrythmias and CV collapse



Propranolol

- Nonselective Beta Blocker

  Hypotension, bradycardia

- Sodium channel blockade

  Wide QRS

  Seizures

Good ER critical care is good toxicologic critical care!

Defend the MAP

- IVF -> Pressors

  Norepi is a great choice

  Vasopressin 2nd

  Epi 3rd


NDC 6332
Glu
for I
(Syn
1 m
For in
intrav
For dia
10 Via
out of reach of ch
RE AT: 20° to 25°C (68
trolled Room Temperature)
ect from fight. Glucagon for I
uld be reconstituted with 1 mL Ste
injection, USP immediately before us
ot store for later use. Read the enclose
rt before use.
container closure is not made with enlised
r latex.
509613
03633255961 36
509613
gon
ction, 1 mg
per vial
muscular or
ous injection.
nostic use only.
itute with Sterile Water
ection, USP
Rx Water

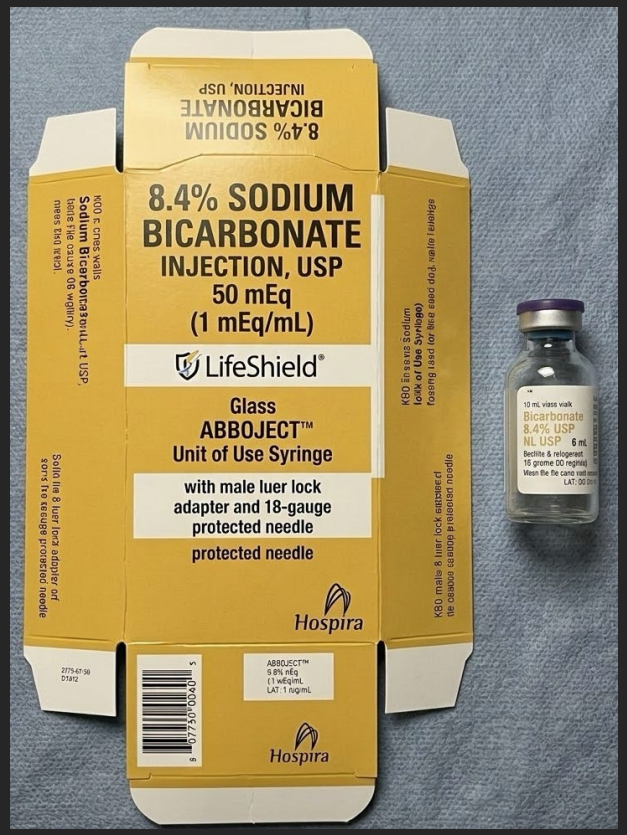
Weak physiological effect

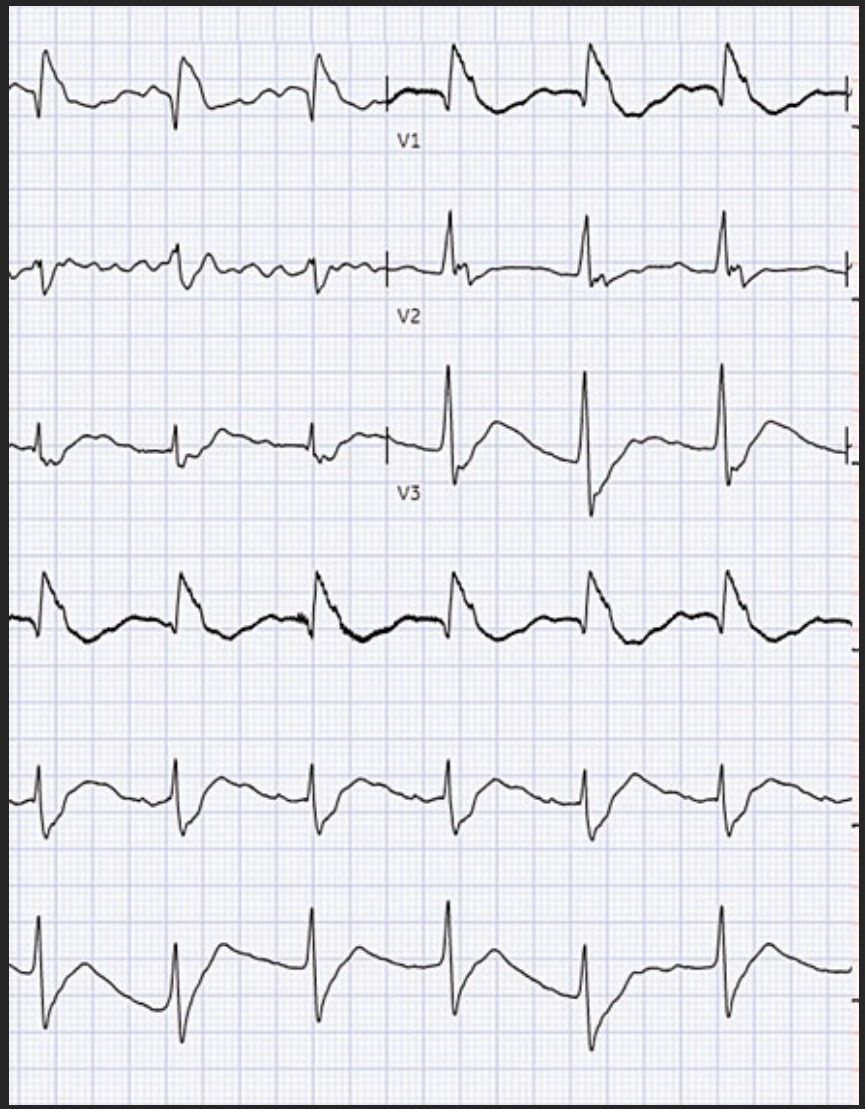
Financially toxic

Unfamiliar


601

Wide QRS


8.4% SODIUM
BICARBONATE
INJECTION, USP
50 mEq
(1 mEq/mL)
LifeShield
Glass
ABBOJECT™
Unit of Use Syringe
with male luer lock
adapter and 18-gauge
protected needle
Hospira


V1
V2
V3

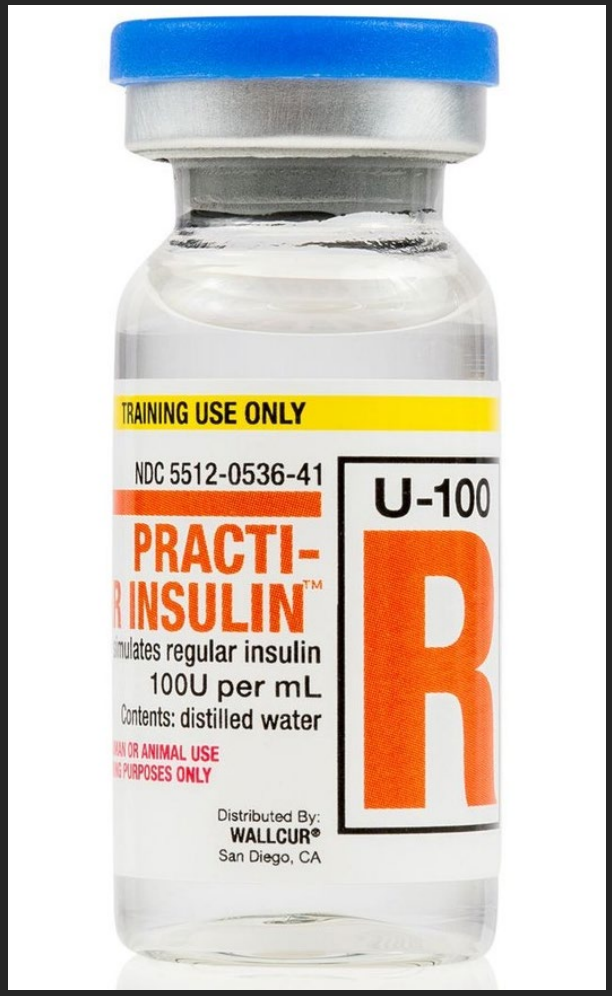
Still hypotensive?

- Increase pressors beyond “max”
- Trial High Dose Insulin

High Dose Insulin

- Improves cardiac contractility
- Vasodilatory
- 1 U/kg bolus + D50 amp -> 1 U/kg/hr gtt + dextrose gtt

  Watch for hypoglycemia and hypokalemia



STILL hypotensive?

- Trial your vasoplegia adjuncts

Methylene Blue

- 1 mg/kg bolus IV

  Watch for serotonin toxicity

Hydroxocobalamin

- 5g bolus IV

  Watch for lab irregularities

Don’t forget mechanical support for your cardiotoxic patients!

VA-ECMO

- Overdose patients often ideal ECMO candidates

  Previously well

  Single problem

- Too early is much better than too late!

J Card Surg. 2022;37:1512–1519.

ORIGINAL ARTICLE | Full Access

Veno-arterial extracorporeal membrane oxygenation for drug intoxications: A single center, 14-year experience

78% overall survival!

88% survival if cannulated prior to cardiac arrest!

Severe Cardiac Toxicity: Peals & Pitfalls

- Good critical care is the most important step
- Remember your refractory cardiogenic shock (high dose insulin) and vasoplegic shock (methylene blue, hydroxocobalamin) adjuncts

- Don’t over-rely on “antidotes”
- Don’t forget mechanical circulatory support

Thank you!

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CALIFORNIA POISON CONTROL SYSTEM

UCSF Department of Emergency Medicine