Salicylate Poisoning

Grigory Ostrovskiy, MD
Assistant Professor of Emergency Medicine
Weill Cornell Medicine - Qatar
Only the dose makes the poison.

Paracelsus
Professor of Medicine
University of Basel
Abbreviations

- ASA = Aspirin
- APAP = Acetaminophen
Case

- 75 year old female presents to the ED
- Awake and Alert to Person, Place and Time
- BP 181/82
- HR 78
- RR 22
What is Aspirin?
History
HIPPOCRATES, HIRAclidæ. F. COVS.
He grounded his Precepts upon Aeschylus. He was by some of the Prince of Physicians, & by others honoured as a God, and his Works are in this Day greatly esteemed in most parts of Europe. He lived at 104 Years of Age, above 400 Years before the Birth of Christ.
History
Today
• Anacin: ASA or APAP
• Excedrin: ASA, APAP, or both
• Alka Seltzer: ASA or APAP
• Pepto Bismol: ASA
What does ASA do?
Pharmacology

• Cycloxygenase (COX) I & II inhibition
• Direct inhibition of neutrophils
Without ASA

COX-1:

Arachidonic Acid
   -> Thromboxanes
      -> Platelet aggregation & Vasoconstriction

COX-2:

Arachidonic acid
   -> Prostaglandins
      -> Inflammation
With ASA

**COX-1** *(Acetylated = Irreversibly inhibited)*:

Arachidonic Acid
- $\rightarrow$ Thromboxane A2
  - $\rightarrow$ Platelet aggregation & Vasoconstriction

**COX-2** *(Enzymatically modified)*:

Arachidonic acid
- $\rightarrow$ Lipoxins *(anti-inflammatory)*
  - $\rightarrow$ No Inflammation
What effects do we expect to see in our patient?
Respiratory Alkalosis

Nausea Vomiting

Altered Mental Status

Tinnitus

Hyperthermia, Lactic Acidosis
The diagram illustrates the electron transport chain and ATP synthesis within a chloroplast. The chain begins with NADH entering the inner membrane, where it donates electrons to the electron transport chain (ETC). The electrons are transferred through the ETC proteins I, II, III, and IV, generating a proton gradient across the inner membrane. The protons then flow back into the matrix space through ATP synthase, driving the synthesis of ATP from ADP and inorganic phosphate ($P_i$).

The ETC proteins also contribute to the formation of a proton gradient across the outer membrane, which drives the synthesis of ATP through oxidative phosphorylation. Oxygen ($O_2$) is reduced to water ($H_2O$) as the final electron acceptor, completing the electron transport chain.

The Citric acid cycle, which generates NADH and FADH$_2$, is also depicted within the matrix space, contributing to the proton gradient and ATP synthesis.

The diagram highlights the interplay between electron transport, proton motive force, and ATP synthesis, essential processes in cellular respiration.
Toxicity

• Respiratory Center Stimulation
• Chemoreceptor Trigger Zone Stimulation
• Uncoupling of Oxidative Phosphorylation
Toxidrome

• Tachypnea, Hyperpnea, Respiratory Alkalosis
• Altered Mental Status
• Hyperthermia
• Lactic Acidosis
Findings in our patient

• Awake, Alert, Oriented x 2
• Nauseated
• Tachypneic (RR 22/min)
• Hyperthermic (T 38.2 c)
How severe is our patient’s poisoning?
Toxic Doses

• <150mg/kg = mild toxicity
• 150 – 300mg/kg = moderate toxicity
• >300 mg/kg = severe toxicity
Pharmacokinetics vs Toxokinetics
Acute vs Chronic
What tests should we get?
Test Results

• FS 120
• ABG
  – pH 7.41
  – pCO2 24
  – pO2 56
• ASA level 57.4
How should we treat our patient?
ABCs

Airway
Breathing
Circulation
Decontamination
Elimination
Fingerstick
Airway

Minimize Apnea
Breathing

Hyperventilate
Circulation

Sodium Bicarbonate
Decontamination

Activated Charcoal
HX  $\rightleftharpoons$  $H^+$  +  $X^-$
Elimination

Alkalinate Urine

Hemodialysis
Indications for HD

- Deterioration/Failure to improve
- Lack of success in alkaninization
- Renal failure
- Severe acid base disturbance
- Acute Lung Injury
- Mechanical ventilation
- Acute toxicity with ASA level >100 mg/dL
- Chronic toxicity with ASA level >60 mg/dL
- Altered Mental Status
Fingerstick

Keep > 160 mg/dl (8.8 mmol/l)
Case Outcome

- Dose of activated charcoal
- Bicarbonate infusion
- Progressive decline in mental status
- Rising ASA level
- Seizure
- Intubation
- Attempted dialysis
- Cardiac arrest
Summary

• Have a high degree of suspicion.
• Ask about amount ingested.
• Ask about time ingested.
• Send an ASA and APAP level.
• Decontaminate.
• Mental status is key.
• Treat Blood Glucose <160.
• Sodium Bicarbonate and Dialysis if necessary.
• Call a Poison Center.
www.poison.org
+1-800-222-1222
References

• Stork CM. Aspirin Poisoning. NYSPC Toxicology Letter. 2011(XVI)3; 1-7

• Lugassy DM. Goldfrank’s Toxicologic Emergencies, 10th edition, Chapter 39: Salicylates.

• Levitan R, Lovecchio F. Tintinalli’s Emergency Medicine, 8th edition, Chapter 189: Salicylates.