

# Case Scenarios in Pediatric Emergency Medicine

## Childhood Poisoning

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# Learning Objectives

- Epidemiology of Childhood Poisoning in Abu Dhabi
- Commonest agents ingested
- General Empirical Approach to Poisoning
- Case Scenarios focusing on cases that are representative of common but esoteric ingestions

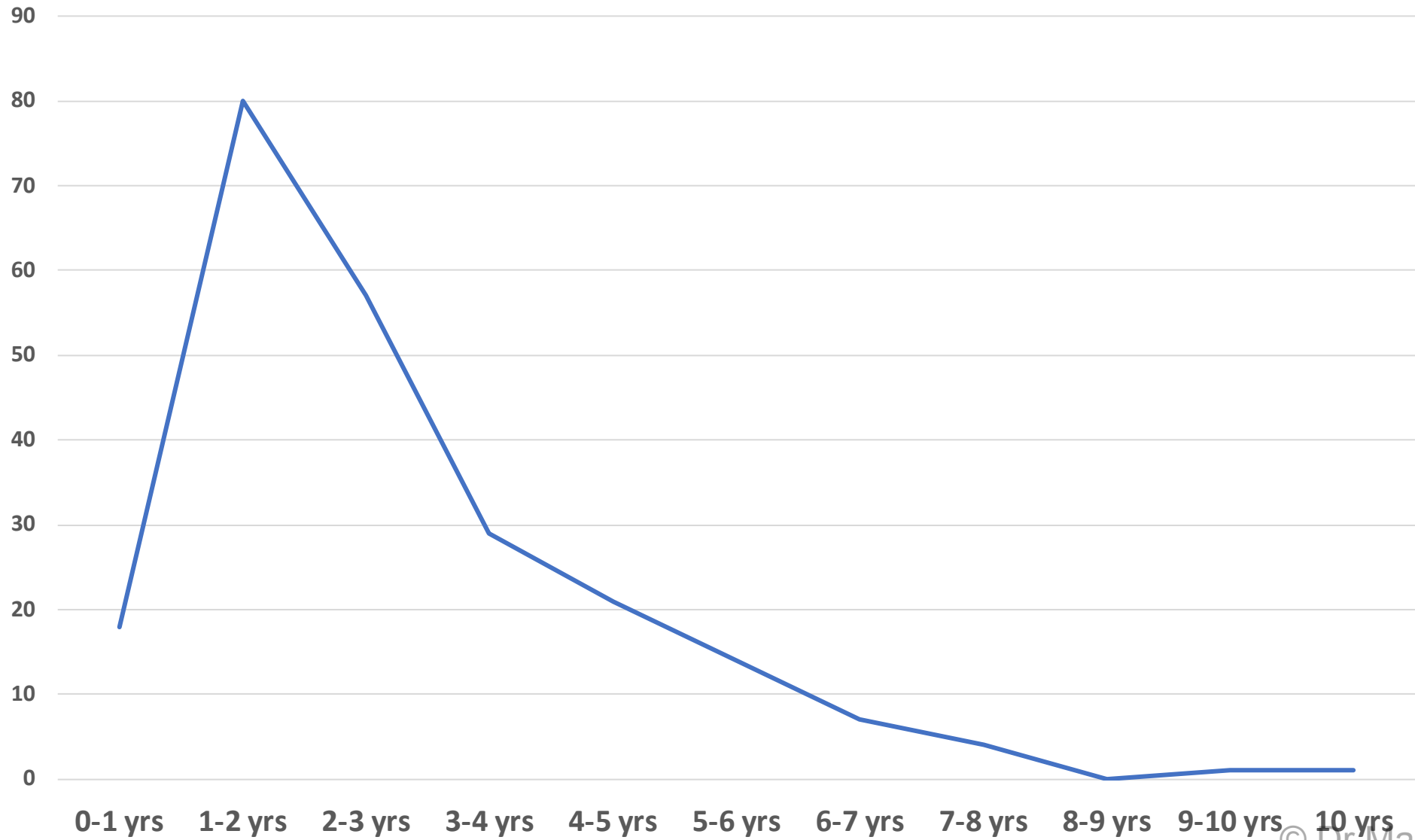


2016 Childhood Poisoning Cases  
Emirate of Abu Dhabi

# Epidemiology in Abu Dhabi

- 1031 children 0-10 years in 2016
- Burden of illness: 0.006% of total Pediatric ED attendances<sup>1</sup>
- Al Ain: 413 (0.35 per 1000 children)<sup>2</sup>
- Abu Dhabi: 544 (0.26 per 1000 children)
- Al Dhafra (Western Region): 74 (0.38 per 1000 children)

# Age at presentation



# Epidemiology Trend in Abu Dhabi

- In 2010 the incidence of childhood poisoning in Al Ain and Tawam Hospitals was 2.35 per 1000 children<sup>3</sup>
- Significant reduction in the incidence of poisoning in children
- This was seen in both Emirati and Expat populations

# Type of poisoning

- 151 (65%) with poisoning from **medicinal** substance
- 81 (35%) with poisoning from **non-medicinal** substances
- Medicine ingestions account for the majority of admitted patients 48 (79% of admissions)

# Medicinal Poisoning Cases

Medicine	Number	Percentage
Paracetamol	23	9.9
NSAIDs	14	6.0
Multivitamin/Minerals	13	5.6
Antihistamine	12	5.2
Vitamin D	10	4.3
Thyroxine	9	3.9
Montelukast	9	3.9
Cardiovascular Meds	5	2.2



# Results - Non-medicinal Poisoning

- Caustic ingestions are the commonest non-medicinal cause of poisoning accounting for 8.6% of total ingestions
- Also accounts for 70% of the cases admitted with non-medicinal poisoning
- Corrosive and battery ingestion resulted in all the endoscopies performed

# Non-medicinal Poisoning Cases

Chemical	Number	Percentage
Bleach	11	4.7
Detergents	8	3.4
Toilet Bowl Cleaner	5	2.2
Other caustics	4	1.7
Pesticide	6	2.6
Silica Powder	6	2.6
Alcohols	5	2.2
Perfumes/Fresheners	7	3

# Case Scenarios



- Caustic ingestion
- Antihistamine
- Thyroxine ingestion
- Petroleum Products

# General Approach to Toxic Ingestions Evaluation

- Be meticulous in establishing as many details as possible from as many sources as possible.
- Assume worst case scenario in terms of ingestion
- Anticipate potential complications based upon possible ingested medications
- These may be related to the class of medication but may also be idiosyncratic to the specific medication or to the medication in overdose (Use reference text)

# General Approach to Toxic Ingestions Management

- Consider gastric decontamination
- Use antidote if available
- **Cornerstone of care is appropriate supportive measures**
- Establish safe discharge and follow up criteria at the outset
  - Based upon reference advice (Micromedex, UptoDate, Toxbase, Consultation)
  - Time to peak plasma concentration and elimination half life of the medication

# Gastric Decontamination

- GASTRIC LAVAGE **NOT** ROUTINELY RECOMMENDED
- Evidence would indicate 40-50% of gastric contents remain in the stomach and up to 1/3<sup>rd</sup> are propelled forward<sup>4,5</sup>
- When compared to activated charcoal alone the vast majority of the evidence shows either no benefit or worse outcomes, mainly due to aspiration<sup>6,7</sup>
- One study in which GL was only carried out on obtunded patients indicated some benefit with p value <0.05 if administered within 1 hour.<sup>8</sup>
- **GL SHOULD ONLY BE CONSIDERED FOR OBTUNDED INTUBATED PATIENTS WITHIN 1 HOUR OF INGESTION.** (In practice this will mean that in accidental poisoning in children it will practically never be used)

# Case Scenario 1



- 14 month old child ingested an unknown amount of AC Cleaning Liquid consisting of Sodium Hydroxide.
- Mother noted lip swelling and facial redness. Child brought to ER.
- On examination child had marked lip swelling but was otherwise well looking. Normal vital signs.
- Oropharyngeal examination revealed 1 small ulcer of the tongue but was otherwise unremarkable.
- Labs unremarkable.



Should the child undergo endoscopy, inpatient observation or discharge from ED?

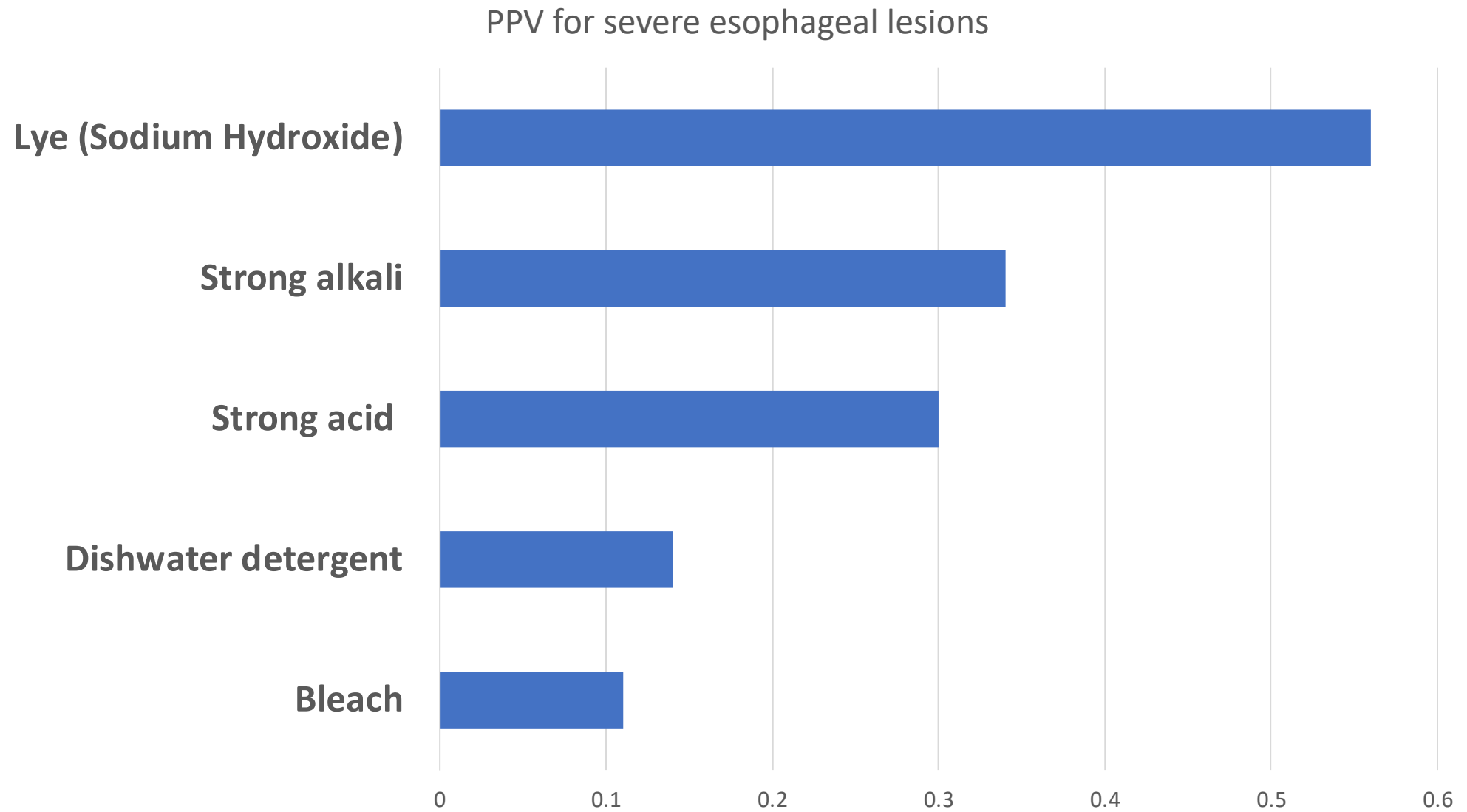
Evidence for the reliability of symptoms and signs as a predictor of esophageal injury is mixed.<sup>9,10,11</sup>

# Caustic ingestion

## Household Products containing alkalis or acids

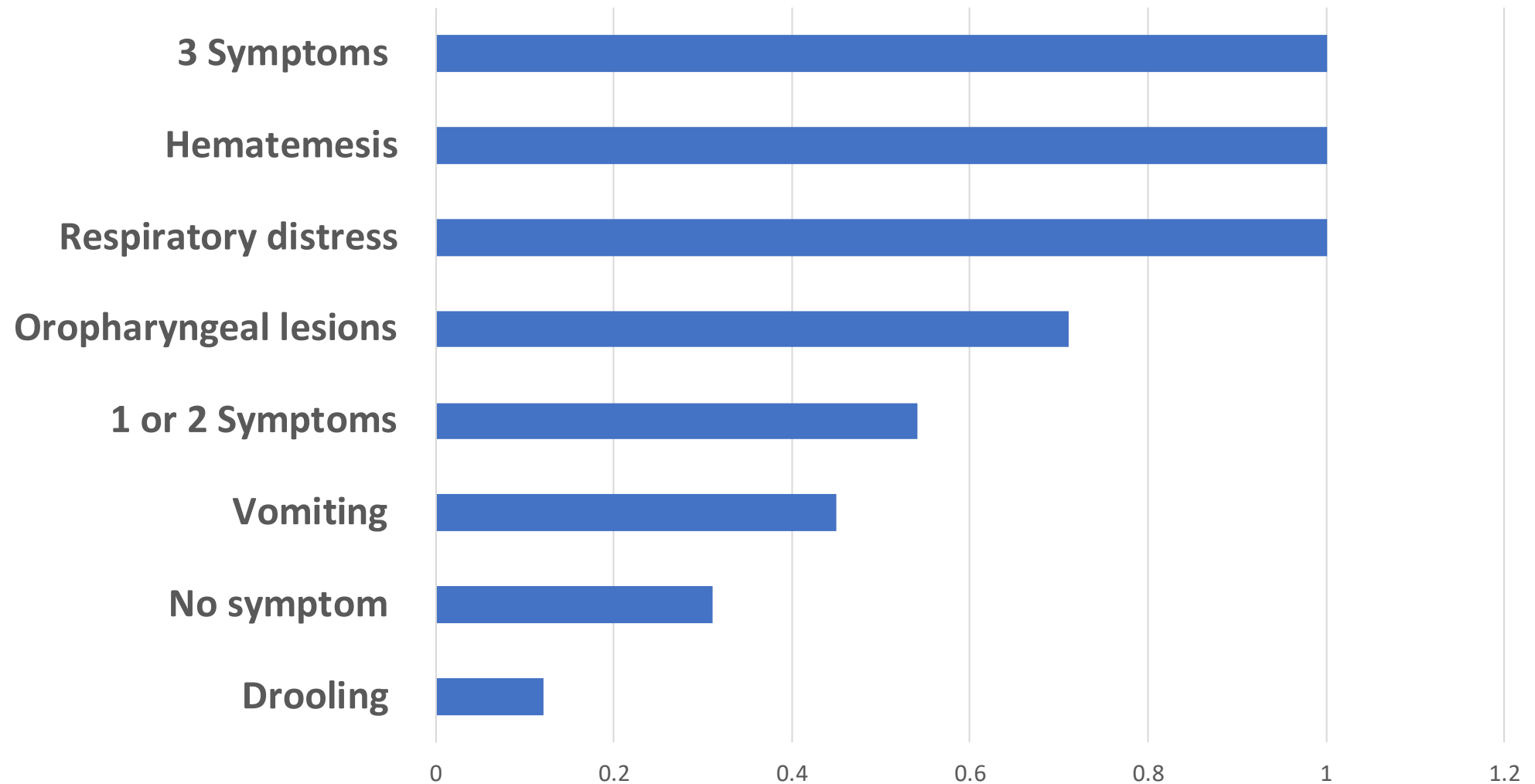
- Alkalis: bleach (chlorine-based), ammonia or sodium hydroxide
  - Acids: toilet cleaners containing HCl, bleach (peroxide-based)
- 
- Ingested substances (Abu Dhabi) in order of frequency<sup>1</sup>:
    - Bleach (Clorox)
    - Toilet Bowl Cleaner
    - Drain cleaner/opener





Positive predictive value for severe esophageal lesions according to ingested caustic<sup>10</sup>

PPV for severe esophageal lesions



Positive predictive value for severe esophageal lesions according to symptoms<sup>10</sup>

# Caustic ingestion

Child does not usually need an endoscopy if:

1. Ingestion was **accidental** OR it is **unclear** if the child actually ingested anything
2. The suspected product is of **low causticity** (ex: household bleach)
3. Patient is **asymptomatic** for 2-4 hours of observation
4. Examination reveals **no signs of oropharyngeal injury**

# Case Scenario 2

## Antihistamines



- 4 year old ingested 20mls of Fenistil
- Mother witnessed the ingestion and brought straight to the ER within 60 mins
- Child symptom free
- Normal physical examination with normal vital signs
- Activated charcoal given immediately

# Antihistamine

- Commonest antihistamine medications ingested in Abu Dhabi were (in order of frequency)<sup>1</sup>:
  - Cetirizine
  - Dimethindine (Fenistil)
  - Chlorpheniramine
  - Diphenhydramine








# Antihistamine

- For therapeutic doses:
  - Peak plasma concentration: Range 1 hr (cetirizine) – 6 hrs (chlorpheniramine)
  - Half Life: 2-42 hrs
  - Duration of Action: 6-8hrs (chlorpheniramine/diphenhydramine) – 24 hrs (cetirizine)
- No studies available studying pharmacokinetics of the medications in overdose

## Clinical complications & mechanisms<sup>12,13,14,15</sup>

- Drowsiness: H1 receptors
- Anticholinergic Toxidrome: Muscarinic Receptors →
- Uncommonly for diphenhydramine a serotonin syndrome has been reported (idiosyncratic)
- Idiosyncratic Cardiotoxicity with QT prolongation rarely with cetirizine
- Idiosyncratic Cardiotoxicity (Prolonged QTc/Brugada/VTs)
- Neurotoxicity for diphenhydramine

### Anticholinergic Toxidrome

	<b>Mad as a hatter</b> Altered mental status
	<b>Blind as a bat</b> Mydriasis
	<b>Red as a beet</b> Flushed skin
	<b>Hot as a hare</b> Dry skin (anhydrosis)
	<b>Dry as a bone</b> Dry mucous membranes

# Antihistamine

- Observe 6 hours minimum
- All patients require 12 lead ECG
- Symptomatic patients require basic labs
- Sick patients require supportive measures as necessary
- CPR may need to be prolonged because of some evidence of recovery without neuro sequelae after prolonged CPR

# Case Scenario 3

## Thyroxine



- 3 year old child
- Accidental ingestion of 3 x 100mcg tablets of her mother's thyroxine 1 hour prior to arrival.
- Thyroxine similar in appearance to homeopathic medication the child was being given on a daily basis
- Child remained completely symptom free
- Physical examination normal
- Activated charcoal given

# Main Clinical Questions

Should we do baseline labs?

Should we observe or discharge?

Does she need admission for extended observation?

# Acute Thyroxine Overdose

- Evidence consists largely of case reports
- 7 case series
- No dose-response relationship between the occurrence or severity of symptoms and amount levothyroxine ingested.
- 2 case reports of seizures developing after overdoses.
- Overwhelming majority of patients develop no or mild symptoms

# Acute Thyroxine Overdose

Evidence Based Advice<sup>16-21</sup>

- For symptomatic patients symptom onset was between 12 and 48 hours but can be delayed
- Observe for 12-24 hrs
- Solid safety net advice
- Review in clinic after 3-6 days (elimination half lives for T4 approx 3 days and for T3 approx 6 days)
- Follow up to continue for up to 2 weeks





# Case Scenario 5

## Hydrocarbons

Petrol

Kerosene

Naphtalene

Camphor

2 year old child brought to ER 30 minutes after ingestion of an unknown quantity of kerosene stored in a mineral water bottle whilst at a barbecue.

Child coughed and vomited at the time.

Symptom free on arrival to ER

Examination including vital signs unremarkable.

# Main Clinical Questions

Should gastric decontamination with AC or GL be performed?

Should we do any investigations particularly CXR?

How long should we observe?

Hydrocarbons are categorized into:

- Aromatic: Benzene, Toluene, Xylene used primarily in solvents, glues, nail polishes, paints and paint removers
- **Aliphatic:** Petroleum distillates like **petrol, kerosene** and **naptha.**
- Halogenated: Chloroform, Carbon tetrachloride
- **Terpene:** Turpentine and Pine oil (**camphor**)

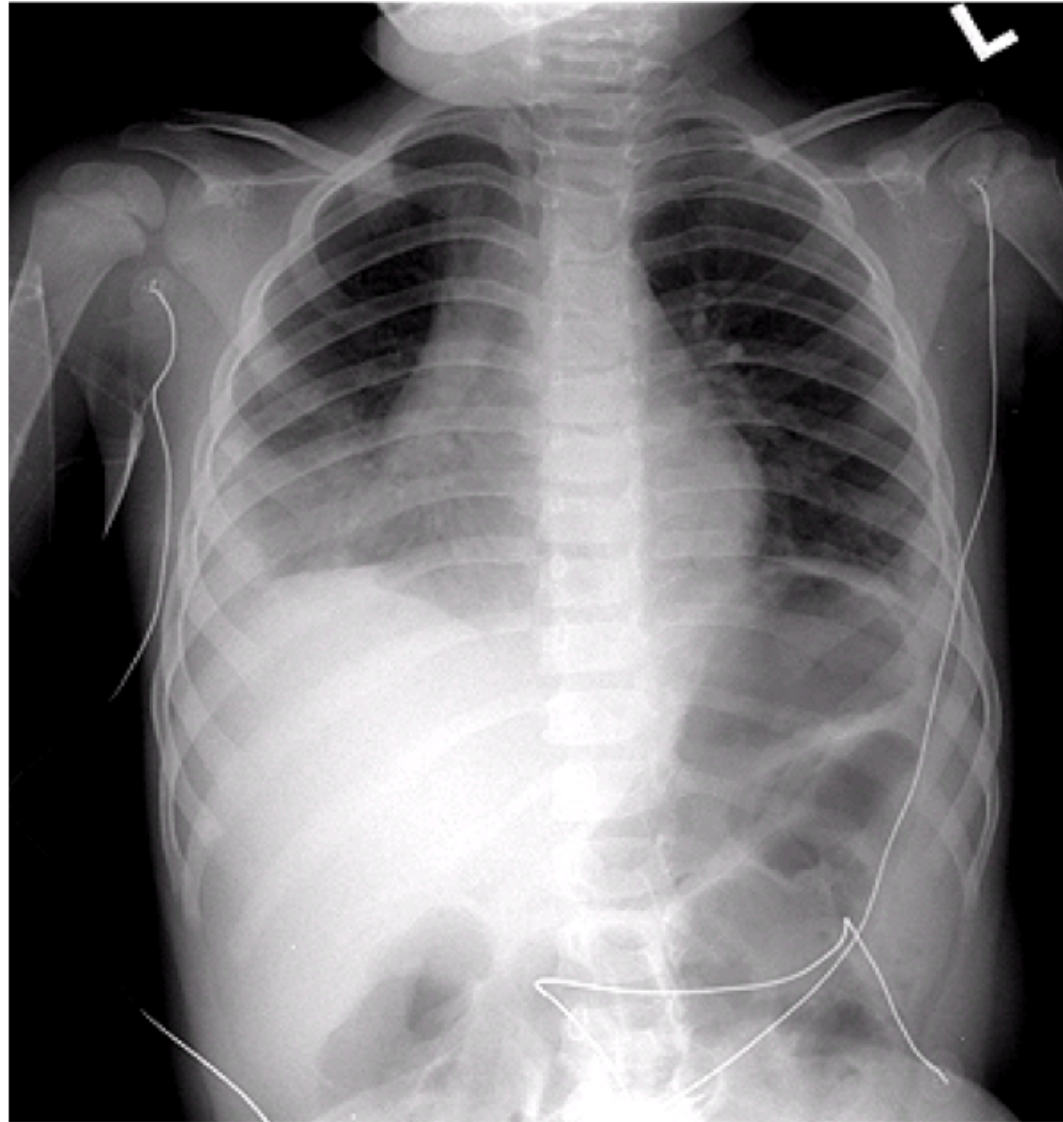
Main accidental hydrocarbon poisoning seen in children in Abu Dhabi are:

- Accidental ingestion of kerosene or petrol that is stored in a mineral water bottle
- Accidental ingestion/exposure to Naphthalene Moth Balls or Camphor in Moth Balls or Vick's VapoRub

# Petrol and Kerosene

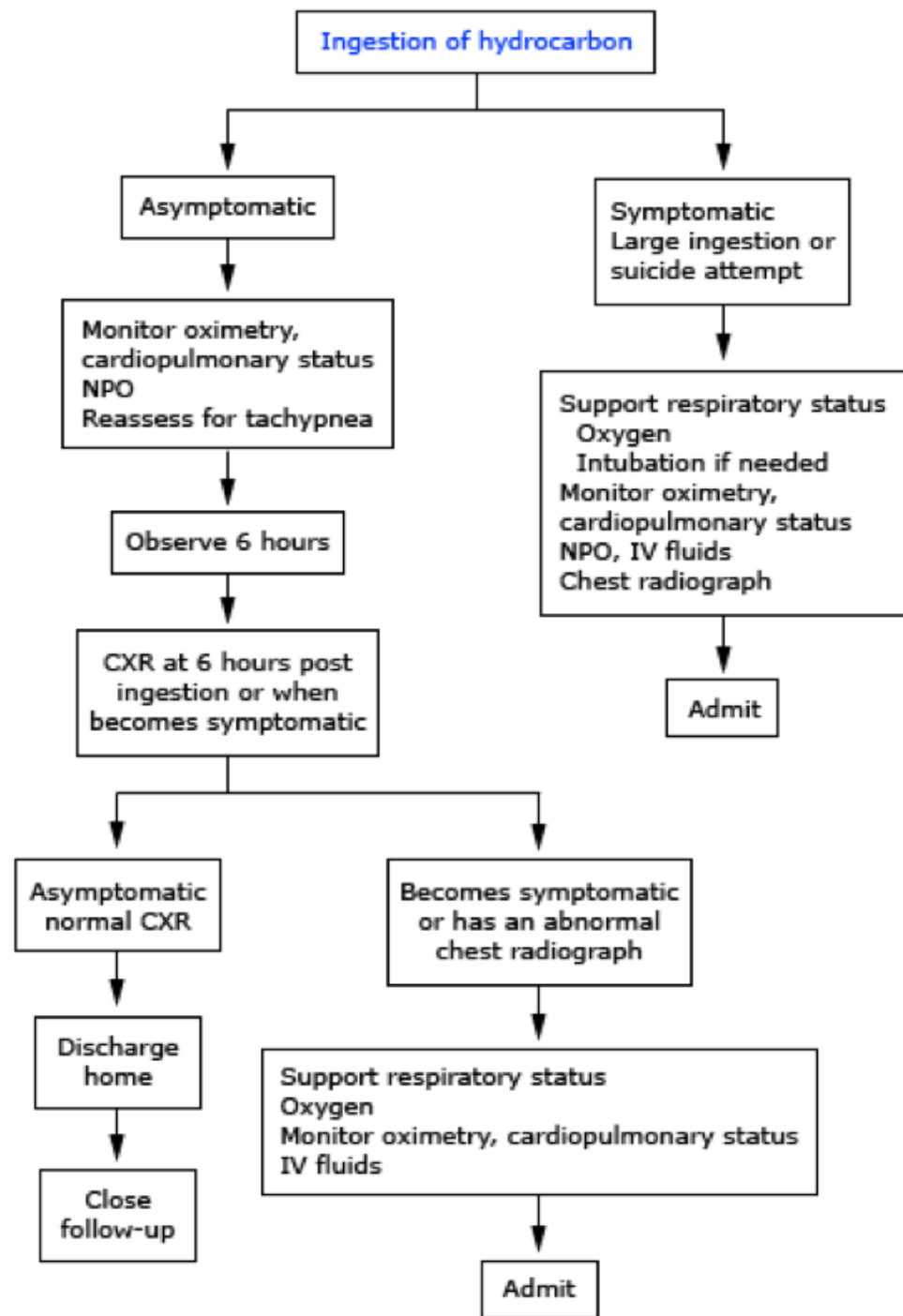
- Main complication of Ingestion of petroleum distillates is pulmonary aspiration
- **Uncommon** occurring in only 1 patient out of 15 identified on our initial review of the data from Abu Dhabi in 2016
- Consistent with the previous studies<sup>24</sup>
- Systemic symptoms are very uncommon and occur more frequently with inhalation

# Hydrocarbon Pulmonary Aspiration



- AC not useful and NOT ADVISABLE GL CONTRAINDICATED
- Treatment is supportive (avoid racemic epi nebs as sensitized myocardium may be prone to ventricular arrhythmias)
- Symptoms occur within 30 mins for the majority but may be delayed<sup>24</sup>
- Symptomatic patients should have CXR and admitted
- Asymptomatic children should be observed for 6 hours then have CXR and discharged if normal





# Naphtalene and Camphor

- Toxicity has been documented with ingestion as well as topical exposure either directly (Vick's VapoRub) or by wearing clothes stored with the mothballs.<sup>23</sup>
- Camphor mainly complicated by CNS toxicity (drowsiness, seizures, delirium). Very rapid onset within 30 mins
- Naphtalene: Methemoglobinemia as well as intravascular hemolysis which is well documented after exposure to naphthalene in patients with G6PD.

# Camphor

- Camphor is HIGHLY TOXIC
- Mainly complicated by CNS toxicity (drowsiness, seizures, delirium). Very rapid onset within 30 mins
- Gastric decontamination may be considered
- ECG and basic labs including LFTs
- Minimum 6 hours observation
- Supportive treatment as necessary

# Naphtalene

- Methemoglobinemia as well as intravascular hemolysis which is well documented after exposure to naphthalene in patients with G6PD.
- All patients to have ECG, U&Es, LFTs, hemolysis screen and methemoglobin levels.
- Observation for at least 4 hours
- However in Case Reports the onset of symptoms for Naphthalene is usually delayed, case reports present within 24-48 hours.

# References

1. Borg M. Accidental Poisoning in Children: The Abu Dhabi Experience so far. 12<sup>th</sup> SEHA International Pediatric Conference 2018.
2. Statistical Yearbook of Abu Dhabi 2017, Statistics Center, Abu Dhabi. Available at [https://www.scad.ae/Release%20Documents/SYB\\_2017\\_EN.PDF](https://www.scad.ae/Release%20Documents/SYB_2017_EN.PDF)
3. Dawson KP; Harron D; McGrath L; Amirlak I; Yassin A; Eastern Mediterranean Health Journal, 1997 Apr; 3(1): 38-42. Available at: <http://www.emro.who.int/ar/emhj-volume-3-1997/volume-3-issue-1/article6.html>.
4. Saetta JP, March S, Gaunt ME, Quinton DN. Gastric emptying procedures in the self-poisoned patient: are we forcing gastric content beyond the pylorus? J R Soc Med. 1991;84(5):274.
5. Tandberg D, Diven BG, McLeod JW. Ipecac-induced emesis versus gastric lavage: a controlled study in normal adults. Am J Emerg Med. 1986;4(3):205.
6. Merigian KS, Woodard M, Hedges JR, Roberts JR, Stuebing R, Rashkin MC. Prospective evaluation of gastric emptying in the self-poisoned patient. Am J Emerg Med. 1990;8(6):479.
7. Buckley NA, Whyte IM, O'Connell DL, Dawson AH. Activated charcoal reduces the need for N-acetylcysteine treatment after acetaminophen (paracetamol) overdose. J Toxicol Clin Toxicol. 1999;37(6):753.

# References

8. Management of acutely poisoned patients without gastric emptying. AUKulig K, Bar-Or D, Cantrill SV, Rosen P, Rumack BH *SOAnn Emerg Med*. 1985;14(6):562.
9. Gaudreault P, Parent M, McGuigan MA, Chicoine L, Lovejoy FH Jr. Predictability of esophageal injury from signs and symptoms: a study of caustic ingestion in 378 children. *Pediatrics* 1983;71(5):767.
10. Lamireau T, Rebouissoux L, Denis D, Lancelin F, Vergnes P, Fayon M. Accidental caustic ingestion in children: is endoscopy always mandatory?. *J Pediatr Gastroenterol Nutr*. 2001;33(1):81.
11. Gupta SK, Croffie JM, Fitzgerald JF. Is esophagogastroduodenoscopy necessary in all caustic ingestions?. *J Pediatr Gastroenterol Nutr*. 2001;32(1):50.
12. Hansen JJ, Feilberg, Jorgensen NJ. Accidental cetirizine poisoning in a four- year- old boy. *Ugeskr Laeger* 1998; 160: 5946-5947.
13. Ridout SM, Tariq SM. Cetirizine overdose in a young child. *J Allergy Clin Immunol* 1997; 99: 860-861.
14. Spiller HA, Villalobos D, Benson BE, Krenzelok EP, Anderson AD. Retrospective evaluation of cetirizine (zyrtec) ingestion. *J Toxicol Clin Toxicol* 2002; 40: 525-256.
15. Köppel C, Ibe K, Tenczer J. Clinical symptomatology of diphenhydramine overdose: an evaluation of 136 cases in 1982 to 1985. *J Toxicol Clin Toxicol* 1987; 25: 53-70.
16. Lewander WJ, Lacouture PG, Silva JE, Lovejoy FH. Acute thyroxine ingestion in pediatric patients. *Pediatrics*. 1989 Aug;84(2):262-5.
17. Tunget CL, Clark RF, Turchen SG, Manoguerra AS. Raising the decontamination level for thyroid hormone ingestions. *Am J Emerg Med* 1995; 13: 9-13.

# References

18. Nygaard B, Dalhoff KP, Saedder E, Lydeking L, Jurgens G. Acute levothyroxine overdose-unpredictable clinical outcome and late onset symptoms: A case series. *Clinical Toxicology* 2013; 51 : 284-285.
19. Hartman S, Noordam K, Maseland M, Van Setten P. Benign course after acute high dose levothyroxine intoxication in a 3-year-old boy. *Clin Pediatr Endocrinol*. 2017; 26(3): 171–175.
20. Tsutaoka BT, Kim S, Santucci S. Seizure in a child after an acute ingestion of levothyroxine. *Pediatr Emerg Care* 2005;21: 857–9.
21. Kulig K, Golightly LK, Rumack BH. Levothyroxine overdose associated with seizures in a young child. *JAMA* 1985;254:2109–10.
22. 2016 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 34th Annual Report. Available at [https://aapcc.s3.amazonaws.com/pdfs/annual\\_reports/2016\\_AAPCC\\_NPDS\\_Annual\\_Report.pdf](https://aapcc.s3.amazonaws.com/pdfs/annual_reports/2016_AAPCC_NPDS_Annual_Report.pdf)

# References

23. Santucci K, Shah B. Association of naphthalene with acute hemolytic anemia. *Acad Emerg Med* 2000; 7: 42-47.
24. Anas N, Namasonthi V, Ginsburg CM. Criteria for hospitalizing children who have ingested products containing hydrocarbons. *JAMA*. 1981;246(8):840.



THANK YOU

The text "THANK YOU" is rendered in a playful, hand-drawn style. Each letter is filled with a different color from a rainbow spectrum. Small, simple human figures are positioned around the letters, appearing to be climbing, standing on, or interacting with them. For example, a figure is on top of the 'T', another is on the 'H', and several are on the 'Y' and 'O'. The overall effect is one of joy and human connection.