

Goal

To enhance early recognition, reporting, and clinical management of chemical associated gastrointestinal foodborne illness by clinicians and healthcare providers.

Objectives

- **Distinguish features of chemical associated foodborne illness**
- **Describe epidemiologic clues of a covert chemical associated foodborne illness**

Objectives

- Describe a structured approach to guide the generation of a differential diagnosis targeting various chemical etiologies
- Describe appropriate reporting strategies for suspected covert chemical associated foodborne illness

Objectives

- **Discuss the clinical course and general management of poisoning from various chemicals**

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**Tech Assistance:
800.728.8232**

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Webcast Goals

- Give background
- Distinguish differences between chemical and infectious foodborne illness in patient presentation
- Present epidemiologic clues of chemical illness

Webcast Goals

- **Determine how to recognize a possible covert chemical terrorism foodborne poisoning event**
- **Offer a structured approach to guide the generation of a differential diagnosis targeting chemical etiologies**
- **Discuss possible chemical etiologies and their management**

Historical Example One



Source: Florida Fish and Wildlife Conservation Commission,
Fish & Wildlife Research Institute(FWC / FWRI)

Pufferfish Origination



Toxin Identification

- Presumptive diagnosis by history and physical exam
- Saxitoxin identified in fish and patient biologic samples
- Rapid identification allowed targeted therapy

Pufferfish may contain a dangerous toxin called "saxitoxin."



Saxitoxin cannot be removed by cleaning or cooking. Saxitoxin has no taste, color or smell.

Contact your personal physician immediately for diagnosis and treatment if you have eaten pufferfish and have any of the following symptoms:

- Tingling, burning or numbness of the mouth, tongue, lips, face, arms, fingertips and legs
- Possibly nausea or vomiting
- Drowsiness
- Incoherent speech
- Respiratory distress

**Do not eat pufferfish—they may be poisonous.
¡No coma pescado "puffer," puede ser venenoso!**

Division of Environmental Health

Source: Florida Department of Health

Historical Example Two

- Rapid onset of illness
- Some had received food, others only fountain drinks
- Incubation period about 10 minutes



Epidemiological Investigation

- No obvious health code violations
- 7 out of 10 patrons consumed fountain drinks
- Samples collected
 - Ice
 - Water
 - Carbonated beverages



Laboratory Identification

- Copper concentrations seven times higher than limit

Laboratory Identification

- **Copper concentrations seven times higher than limit**
- **Leaching of copper from pipes**
 - **Restaurant Worker Syndrome**
- **All ill persons recovered**

Historical Example Three

- **Sixteen people fall ill at a church**
- **Infectious etiology initially suspected**
- **Chemicals considered more likely as event progresses**
 - **New England Poison Control Center contacted**
 - **Health Department contacted**

Arsenic Poisoning in Maine

- **Intentional contamination of coffee with arsenic by parishioner**



Infectious Foodborne Illness

Symptoms

- **Mean incubation periods usually >12 hours**
- **Some exceptions do occur**
- **Upper or lower GI symptoms**

Chemical Foodborne Illness

Symptoms

- **Symptoms similar to some aspects of flu or an infectious gastroenteritis**
 - **Upper GI symptoms predominate**
- **Short latency, usually < 12 hours**
 - **Often within minutes of exposure**

Chemical Foodborne Illness

Symptom Clues

- **Rapid onset of illness following meal**
 - **Often < 30-60 minutes**
 - **Almost always < 6-12 hours**

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- **Organoleptic comments**

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- **Organoleptic comments**
- **Symptoms**
 - **Vomiting, neurologic symptoms, burning, or other sensations**

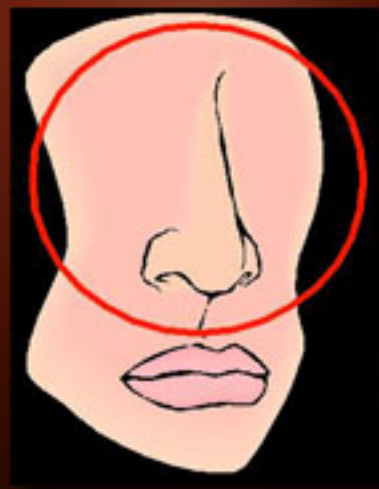
Chemical Foodborne Illness

Clinical Clues

- **Metabolic acidosis**
- **Hypoglycemia**
- **Tachycardia**
- **Hypotension**
- **Tachypnea**
- **Neurologic and other symptoms**

Organoleptic Comments & Clues

- Unusual appearance of food
- Strange smell
- Odd taste



Chemical Foodborne Illness

Clinical Course

- **Dependent on type and amount of chemical**
- **Treatment needs are agent-dependent**
 - **Antidotes**
 - **Supportive treatment**
 - **Observation**

Chemical Foodborne Illness

Laboratory

- **Rapid and correct biologic sample collection**
 - **Urine**
 - **First vomitus**
 - **Blood**
- **Proper sample storage**
- **Laboratory analysis for agent, metabolite or surrogate marker**



Chemical Foodborne Illness

Laboratory

- **Chemical agents measurable in urine**
 - **Short elimination half-life**

Chemical Foodborne Illness

Laboratory

- **Chemical agents measurable in urine**
 - **Short elimination half-life**
- **Collect:**
 - **Urine from ill and non-ill exposed persons (controls)**
 - **Initial vomitus**
 - **Implicated food**
 - **Unused specimen containers**

Chemical Foodborne Illness

Laboratory Resources

Guidelines for Specimen Collection

**[www.cdc.gov/foodborneoutbreaks/
guide_sc.htm](http://www.cdc.gov/foodborneoutbreaks/guide_sc.htm)**

Standard Food Questionnaire

- **Commonalities**
 - **Predominant symptoms**
 - **Latency**
 - **Food item availability**
 - **Food types consumed**
 - **Food preparation**

Standard Food Questionnaire

- **Additional questions to ask**
 - **Neurologic and other symptoms**
 - **Organoleptic qualities**
 - **Patient's perceptions of etiologic agent**

Chemical Associated Illness

Barriers to Recognition

- **Symptoms often mimic more common non-chemical etiologies**

Chemical Associated Illness

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- **Exposure over wide geographic and temporal course**

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- **Exposure to >1 agent with overlapping clinical findings**

Chemical Associated Illness

Barriers to Recognition

- **Symptoms often mimic more common non-chemical etiologies**
- **Exposure over wide geographic and temporal course**
- **Exposure to >1 agent with overlapping clinical findings**
- **Clinician less familiar with chemical induced foodborne illness**

Chemical Foodborne Illness

Epidemiologic Clues

- **An unusual increase in the number of patients**
- **Unexplained deaths among young or healthy persons**
- **Emission of unexplained odors**

Chemical Foodborne Illness

Epidemiologic Clues

- **An unusual increase in the number of patients**
- **Unexplained deaths among young or healthy persons**
- **Emission of unexplained odors**
- **Clusters of illness in persons who have common characteristics**
- **Rapid onset of symptoms after an exposure to a potentially contaminated medium**

Classification Scheme

- **Foodborne Poisoning**
 - With neurologic signs and symptoms
 - With cardiotoxic signs and symptoms
 - With multi-system organ failure
 - With localized gastrointestinal effects

Neurologic Findings

- **Cholinergic effects**
- **Parasthesias and weakness**
- **Agitation and/or seizures**

Neurologic Findings

Cholinergic

- Excess acetylcholine levels in synapse
- Observe muscarinic and/or nicotinic signs and symptoms
- Classic cholinergic crisis
 - Organic phosphorous compounds
 - Garden variety insecticides
 - Military grade nerve agents
 - Carbamates



Neurologic Findings

Cholinergic

- Insecticides
 - Organic phosphorous compounds
 - Carbamates

Neurologic Findings

Cholinergic

- **Insecticides**
 - **Organic phosphorous compounds**
 - **Carbamates**
- **Nicotinic agonists**
 - **Nicotine or nicotine-like compounds**
- **Mushrooms**
 - **Muscarine**

Muscarinic Findings

- **D**iarrhea
- **U**rination
- **M**iosis
- **B**radycardia, **B**ronchorrhea,
Bronchospasm
- **E**mesis
- **L**acrimation
- **S**alivation, **S**ecretion, **S**weating

Muscarinic Agonists

- Muscarine containing mushrooms
 - *Clitocybe* and *Inocybe* genus
 - *Amanita muscaria* rare



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Neurologic Findings

Cholinergic Nicotinic

- **Mydriasis**
- **Tachycardia**
- **Weakness**
- **Hypertension and Hyperglycemia**
- **Fasciculations**

Nicotinic Agonists

- Genus *Nicotiana* or the tobacco plant
- Other plants:
 - Lobeline from *Lobelia inflata*
 - Sparteine from *Cytisus scoparius*
 - N-methylcytisine from *Caulophyllum thalictroides* or Blue Cohosh
 - Arecoline from *Areca catechu* or the betel nut



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Neurologic Findings

Parasthesias and Weakness

- **Seafood toxins**
 - Ciguatoxin
 - Tetrodotoxin
 - Saxitoxin
 - Brevetoxin



Ciguatera Poisoning

Symptoms

- **Gastrointestinal illness**
- **Bradycardia**
- **Neurologic symptoms**
 - Paresthesias
 - Reversal of temperature discrimination
 - Headaches



Source: (FWC / FWRI)

Tetrodotoxin Poisoning

Symptoms

- Headache
- Diaphoresis
- Parasthesias
 - Especially in the perioral area
- Gastrointestinal illness
- Ascending paralysis



Source: (FWC / FWRI)

Saxitoxin Poisoning

Symptoms

- **Headache**
 - Perioral and extremity parasthesias
 - Sensation of floating, weakness, paralysis
 - Cranial nerve dysfunction
 - Respiratory failure may occur



Source: (FWC / FWRI)

Brevetoxin Poisoning

Symptoms

- **Neurologic**
 - Paralysis usually not noted
- **Gastrointestinal**
 - Effects more pronounced than saxitoxin



Source: (FWC / FWRI)

Neurologic Findings

Agitation/Seizures

- **Mushrooms (*Gyromitra* or false morel)**
 - Latency approximately 5 hours
 - Gastrointestinal symptoms
 - Other symptoms:
 - Headaches, Myalgias
 - Severe toxicity may include: confusion, refractory seizures and coma
- **Tetramine**
 - Multiple types of tetramine compounds
 - Gastrointestinal symptoms
 - Seizures may progress to status epilepticus

Chemical Foodborne Illness

Cardiotoxicity

Cardioactive Glycosides



Oleander



Lily of the Valley



Digitalis
foxglove



Red Squill

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Cardioactive Glycoside Poisoning

Symptoms

- **Gastrointestinal illness**
- **Neurologic**
 - **Drowsiness, confusion**
- **Cardiac**
 - **Paroxyxmal ventricular contractions**
 - **Dysrhythmias similar to digoxin toxicity**

Chemical Foodborne Illness

Multi-System Organ Failure

- **Plants**
 - *Amanita phalloides*
(death cap mushroom)
 - *Ricinus communis*
(Ricin)
 - *Abrus precatorius*
(Abrin)



Ricinus communis



Abrus precatorius

- **Metals**

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Multi-System Organ Failure

Amanita phalloides

- **Latency of illness 5-6 hours**
- **Gastrointestinal symptoms**
- **Hepatic and renal toxicity 24 to 36 hours after consumption**
- **Death is common after severe poisoning**

Multi-System Organ Failure

Ricin

- Ricinus communis plant
- Inhibits protein synthesis
- Mastication and ingestion of castor beans
- No reports of purified ricin ingestion



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Ricin Poisoning

Symptoms

- **Mild toxicity**
 - **Gastrointestinal illness**
 - **Abdominal cramping**
 - **Oropharyngeal irritation**

Ricin Poisoning

Moderate/Severe Toxicity

- **Severe gastrointestinal losses lead to:**
 - **Dehydration**
 - **Hypovolemic shock**
 - **Tachycardia**
 - **Hypotension**
 - **Decreased urine output**
 - **Altered mental status**
 - **Confusion, disorientation**

Multi-System Organ Failure

Abrin

- Symptoms similar to ricin poisoning
- Treatment supportive in nature



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Multi-System Organ Failure

Metals

- Arsenic
- Mercury
- Iron
- Lead
- Copper
- Cadmium
- Numerous others

As Arsenic
Atomic Number: 33
Atomic Mass: 74.92

Hg Mercury
Atomic Number: 80
Atomic Mass: 200

Fe Iron
Atomic Number: 26
Atomic Mass: 55.85

Pb Lead
Atomic Number: 82
Atomic Mass: 207.20

Cu Copper
Atomic Number: 29
Atomic Mass: 63.55

Cd Cadmium
Atomic Number: 48
Atomic Mass: 112.41

Metal Poisoning

Symptoms

- **Latency 30-60 minutes**
- **Metallic or bitter taste**
- **Gastrointestinal symptoms**
- **Severe fluid loss**
- **Difficult to distinguish from ricin or abrin poisoning**

Chemical Foodborne Illness

Localized GI Illness

- Hydrocarbons
- Detergents
- Caustics
- Selected mushrooms
- Pre-formed toxins
 - *Staphylococcus aureus*
 - *Bacillus cereus*



Localized GI Illness

Exceptions

- Hydrocarbons can be remembered by CHAMP
 - Camphor
 - Halogenated hydrocarbons
 - Aromatic hydrocarbons
 - Hydrocarbons associated with metals
 - Hydrocarbons associated with pesticides

Localized GI Illness

Caustics

- PH
 - Acids
 - Alkalis
- Oxidative states
 - Chlorates
 - Permanganates
 - Chromates



Localized GI Illness

Mushrooms

- *Tricholoma, Rhodophyllus, Chlorophyllum, Boletes, Agaricus and Lactarius*
- Symptoms within 3 hours
- Gastrointestinal symptoms
 - Self-limited



Localized GI Illness

Pre-formed Toxins

- Bacterial growth in food results in toxin formation
- Common bacterial causes of short-incubation, short-duration illness:
 - *Staphylococcus aureus*
 - *Bacillus cereus*
 - *Clostridium perfringens*
- Depends on dose and agent
 - Onset between 30 minutes to 24 hours after ingestion.
- Duration of illness typically < 36 hours

Pharmaceutical Overdose

Poisoning Examples

- Acetaminophen, salicylates and nonsteroidal anti-inflammatory drugs
- Theophylline (Cardiotoxicity/Seizures)
- Lithium
- Digoxin (Cardiotoxicity)
- Colchicine (Multi-system organ failure)
- Podophyllum resin



Summary

- **Classification scheme based on clinical presentation**
 - **Neurologic signs and symptoms**
 - **Cardiotoxic signs and symptoms**
 - **Multi-system organ failure**
 - **Localized gastrointestinal illness**

Regional Poison Control Center

- **1-800-222-1222**
- **Connects caller to closest poison center**
- **Any suspected chemical-associated illness**

ROGUE

Rapid

Onset

Gastroenteritis with

Unexplained

Etiology

- **NCEH/HSB 770-488-3410**
- **NCID/FDDB 404-639-2206**

Public Health Foundation

1-877-252-1200

www.phf.org

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