

# FOOD POISONING

PRESENTED BY: AMR RAKHA

RESIDENT IN OEM DEPARTMENT, KASR AL AINY TEACHING HOSPITALS

RESIDENT IN CLINICAL AND ENVIRONMENTAL TOXICOLOGY CENTER, KASR  
AL AINY TEACHING HOSPITALS

# WHAT IS FOOD POISONING?

- An illness caused by the consumption of food or water contaminated with bacteria and/or their toxins, or with parasites, viruses, or chemicals.

# INTRODUCTION

Food-poisoning is a common cause of epidemic gastroenteritis.

In general, the illness is relatively mild and self-limited, with recovery within 24 hours.

However, severe and even fatal poisoning may occur with listeriosis, salmonellosis, or **botulism** and with certain strains of *Escherichia coli*.

# SIGNIFICANCE

It can be caused by:

- Bacteria and their toxins
- Poisoning after the consumption of **fish and shellfish**
- **Mushroom** poisoning.
- **Viruses** such as the Norwalk virus and Norwalk-like caliciviruses, enteroviruses, and rotaviruses (are the causative agent in as many as 80% of food-related illness.)
- Other microbes that can cause food-borne illness include *Cryptosporidium* and *Cyclospora*, which can cause serious illness in immunocompromised patients.
- Chemicals: additives ,pesticides .. Etc.

However, in over half of reported food-borne outbreaks, no microbiologic pathogens are identified.

# HOW TO DIAGNOSE A FOOD POISONING?

- History.
- Clinical picture.
- Stool analysis/culture
- Suspect food/agent analysis.

# TOXIC DOSE

The toxic dose depends on:

- The type of bacteria or toxin
- Its concentration in the ingested food,
- Individual susceptibility or resistance.

Some of the preformed toxins (eg, staphylococcal toxin) are heat resistant and once in the food are not removed by cooking or boiling.

# CLINICAL PRESENTATION (GENERAL)

Commonly, a delay or "incubation period" of 2 hours to 3 days.

- Gastroenteritis
  - is the most common finding, with nausea, vomiting, abdominal cramps, and diarrhea.
  - Vomiting is more common with preformed toxins.
  - Significant fluid and electrolyte abnormalities may occur, especially in young children or elderly patients.
- Systemic infection can result from E coli, Salmonella, Shigella, Campylobacter, or Listeria.
  - Listeriosis → cause sepsis and meningitis, particularly in elderly and immunocompromised persons. Infection during pregnancy produces a mild flu-like illness in the mother but serious intrauterine infection resulting in fetal death, neonatal sepsis, or meningitis
  - Shigella and E coli O157:H7 strain → acute hemorrhagic colitis complicated by hemolytic-uremic syndrome, renal failure, and death, especially in children and immunocompromised adults
  - Campylobacter infections sometimes are followed by Guillain-Barré syndrome or reactive arthritis.

## CLINICAL PRESENTATION (SYSTEMIC)

- Systemic infection can result from E coli, Salmonella, Shigella, Campylobacter, or Listeria.
  - Listeriosis →
    - Sepsis and meningitis, particularly in elderly and immunocompromised persons.
    - Infection during pregnancy produces a mild flu-like illness in the mother but serious intrauterine infection resulting in fetal death, neonatal sepsis, or meningitis
  - Shigella and E coli O157:H7 strain →
    - Acute hemorrhagic colitis complicated by hemolytic-uremic syndrome, renal failure, and death, especially in children and immunocompromised adults
  - Campylobacter infections sometimes are followed by Guillain-Barré syndrome or reactive arthritis.



# INVESTIGATION

It is often difficult to distinguish bacterial from common viral gastroenteritis (unless the incubation period is short and there are multiple victims who ate similar foods at one large gathering).

- Stool analysis:
  - Many white blood cells in a stool smear suggests invasive bacterial infection.
- Stool culture:
  - May differentiate Salmonella, Shigella, and Campylobacter infections.
  - However, culture for E coli O157:H7 must be specifically requested.
  - ELISA test can detect Norwalk virus in stools.
- Blood and CSF culture → Listeria (and rarely Salmonella or Shigella).
- Food samples
  - should be saved for bacterial culture and toxin analysis, primarily for use by public health investigators.
- Antigen testing for Giardia can rule out this infection as a cause of diarrhea.

# INVESTIGATION

- CBC, electrolytes, glucose,
- KFT (especially in mushroom toxicity and needs be repeated up to 1 -2 weeks) .
- CKP (Rhabdomyolysis occurs in mushroom toxicity)
- LFT (delayed rise in mushroom toxicity after 2-3 days)
- CXR → allergic pneumonitis (in mushrooms)

# PREVENTION

## Buying groceries

- Buy meat and seafood items only from hygienic outlets.
- Do not buy items whose expiry date has elapsed.
- Do not buy items containing undercooked or raw animal-derived ingredients.
- Buy only pasteurised milk or cheese.
- Do not buy eggs which are cracked or leaking.

# PREVENTION

## Storage

- Take groceries directly home and store immediately in the refrigerator .
- Always store raw meat, poultry, or seafood in plastic bags, so that drippings do not contaminate other items in the refrigerator.
- Hot foods should be eaten immediately, or kept hot ( $> 60^{\circ}\text{C}$ ), or refrigerated.
- Do not store eggs in the egg-section of the door (provided in most refrigerators), since adequate cooling does not occur. Place them inside cartons and store them in the main section of the refrigerator.

# PREVENTION

## Temperature Requirements

Never leave cut vegetables/meat in the open. Refrigerate them, or cook them.

Ensure that the temperature in the main section of the refrigerator is always below 4° C, and that of the freezer is below -18° C.

Cook all meat and seafood thoroughly before eating. Never consume undercooked oysters, clams, mussels, sushi, or snails.

Cook eggs until both the yolk and white are firm. Never eat runny yolk.

Reheat food or heat partially cooked foods all the way through to at least 74° C.

If any food item looks or smells suspicious, discard it.

# PREVENTION

giene

Wash hands, utensils, and counters with water and soap between preparation of different foods (especially raw meat, poultry, fish, eggs).

Use plastic or glass cutting boards for slicing vegetables or meat. Wooden boards are extremely difficult to clean adequately.

Wash fresh fruits and vegetables under running water

# PREVENTION

## ing Out

Avoid consuming uncooked animal-derived dishes (sushi, raw oysters, hollandaise sauce, eggnog, mayonnaise, etc.).

Do not eat undercooked meat or poultry.

Do not consume egg preparations with runny yolk.

## eign Travel

Drink only boiled or bottled water.

Do not eat raw vegetables and salads.

Do not buy food items from roadside vendors.

# TREATMENT

Usually patient needs close observation for up to 1 day

## ABCDE

- A: especially in fish-toxicity (which can present with respiratory failure)
- C: Replace fluid and electrolyte losses with intravenous Ringer lactate, saline or other crystalloid solutions (patients with mild illness may tolerate oral rehydration). Then shift to oral re-hydration when stable

## Decontamination :

- Not indicated in most cases.
- Activated charcoal can be used immediately after ingestion of a highly toxic seafood – mushroom toxicity (multiple doses)



# TREATMENT

## Supportive treatment:

- Antiemetic agents: are acceptable for symptomatic treatment,
- Antidiarrheal agents: (such as Lomotil) should not be used in patients with suspected invasive bacterial infection (fever and bloody stools).
- Anti-allergic measures: for fish poisoning

# TREATMENT

Specific drugs and antidotes.

- There are no specific antidotes. But antibiotics can be used as follow:
  - In patients with invasive bacterial infection,
  - Only after the stool culture reveals the specific bacteria responsible,
  - Put in consideration that antibiotics do not always shorten the course of illness, and with E coli 0157:H7 they may increase the risk of hemolytic-uremic syndrome.
  - Empiric treatment with trimethoprim-sulfamethoxazole or quinolones is often initiated while awaiting culture results.
- In Pregnant women who have eaten Listeria-contaminated foods:
  - Treat empirically, even if only mildly symptomatic, to prevent serious intrauterine infection.
  - The antibiotic of choice is intravenous ampicillin, with gentamicin added for severe infection.

# TREATMENT

Specific drugs and antidotes.

- In mushroom toxicity according to type we can give the follow:
  - **Pyridoxine** (Vitamin B6),
  - **Methylene blue**, 1 mg/kg IV (for Methemoglobinemia).
  - **Atropine** (for muscarinic symptoms)
  - **Steroids** (for Allergic pneumonitis)
  - Liver support up to liver transplantation (in mushroom induced hepatitis)

# EXAMPLES OF BACTERIAL INDUCED FOOD POISONING

Dominant	Onset of symptoms	Common Symptoms and Mechanism	Foods affected and means of transmission
<i>Shigella</i>	1 to 3 days	D+. Invasive infection.	Raw or contaminated meat, poultry, milk or egg yolks. Survives inadequate cooking. Can be spread by knives, cutting surfaces or an infected food handler.
<i>Vibrio</i>	24 to 48 hours	D+. Invasive infection.	Seafood and raw, ready-to-eat produce. Can be spread by an infected food handler.
<i>Staphylococcus aureus</i>	1 to 6 hours	V > D. Toxin preformed in food; heat-resistant.	Meats and prepared salads, cream sauces, and cream-filled pastries. Can be spread by hand contact, coughing and sneezing.
<i>Vibrio vulnificus</i>	1 to 7 days	V, D+. Invasive and toxin produced in gut.	Raw oysters and raw or undercooked mussels, clams, and whole scallops. Can be spread through contaminated seawater.
<i>Escherichia coli</i>	3–7 d	D+. Invasive infection.	Water; meats; dairy.

# EXAMPLES OF BACTERIAL INDUCED FOOD POISONING

Dominant	Onset of symptoms	Common Symptoms and Mechanism	Foods affected and means of transmission
<i>Escherichia coli</i> "enterotoxigenic"	12–72 h	D > V. Toxin produced in gut.	"Traveler's diarrhea." Water, various foods; direct contact (eg, food handlers).
<i>Escherichia coli</i> "enteroinvasive"	24–72 h	D+. Invasive infection.	Water, various foods; direct contact (eg, food handlers).
<i>Escherichia coli</i> (E. Coli – hemorrhagic) O157:H7	1 to 8 days	D+, S. Toxin produced in gut.	Beef contaminated with feces during slaughter. Spread mainly by undercooked ground beef. Other sources include unpasteurized milk and apple cider, alfalfa sprouts, and contaminated water.
<i>Salmonella</i> <i>monocyto genes</i>	9 to 48 hours	D+, S. Invasive infection.	Hot dogs, luncheon meats, unpasteurized milk and cheeses, and unwashed raw produce. Can be spread through contaminated soil and water.
Viruses (Norwalk-like)	12 to 48 hours		Raw, ready-to-eat produce and shellfish from contaminated water. Can be spread by an infected food handler.
Parasites	1 to 3 days		Raw, ready-to-eat produce. Can be spread by an infected food handler.

# EXAMPLES OF BACTERIAL INDUCED FOOD POISONING

Contaminant	Onset of symptoms	Common Symptoms and Mechanism	Foods affected and means of transmission
Salmonella	2 to 5 days	D+, F. Invasive and possibly toxin produced in gut.	Meat and poultry. Contamination occurs during processing if animal feces contact meat surfaces. Other sources include unpasteurized milk and contaminated water.
Clostridium botulinum	12 to 72 hours		Home-canned foods with low acidity, improperly canned commercial foods, smoked or salted fish, potatoes baked in aluminum foil, and other foods kept at warm temperatures for too long.
Clostridium perfringens	8 to 16 hours	D > V. Toxin produced in food and gut.	Meats, stews and gravies. Commonly spread when serving dishes don't keep food hot enough or food is chilled too slowly.
Giardia lamblia	1 to 2 weeks		Raw, ready-to-eat produce and contaminated water. Can be spread by an infected food handler.
Shigella	28 days		Raw, ready-to-eat produce and shellfish from contaminated water. Can be spread by an infected food handler.

BOTULISM

## 3 Bs

- Botulinum bacteria & Botulinum toxin
- PNS & Paralysis
- Breathing & Botulinum antitoxin



## WHAT IS BOTULISM

- Botulism is a disease caused by *Clostridium botulinum* bacteria.

ANY CLOSTRIDIUM IS

- Bacilli (Rods)
- Gram-positive anaerobic
- Anaerobes
- Spore forming
- Limited invasive power (only in favorable conditions)
- But powerful exotoxins

# CLOSTRIDIUM BOTULINUM

- Botulus = the Latin word for sausage
- Because this classic foodborne poisoning was directly linked to inadequate preservation of varied forms of sausages more than 200 years ago.

## ROUTE (INGESTION = FOODBORNE BOTULISM)

- Contaminated preserved food (canned meat and meat products, fruits, vegetables, pickles, and fish)
- Suspect if
  - bulging can with explosion on opening (due to compressed fluid and little gas from reaction with the tin layer)
  - Peculiar/putrefied tasting or smell. (in type A and B but not in E)

ROUTE (INGESTION = FOODBORNE BOTULISM)

Can we See it in children less  
than 1 year?

## ROUTE (INGESTION = INFANTILE BOTULISM)

- Infant botulism most probably is caused by contaminated honey.
- US banned honey for infants under the age of 6 M (and some up to 1 year) not be given honey.
- To a lesser extent, due to home canned baby food (With Toxin A)

ROUTE (CONTACT = WOUND BOTULISM)

Wound botulism results from wound infection with *C. botulinum*.

## ROUTE (IATROGENIC = THERAPEUTIC BOTULISM)

- Currently, doses ranging between 10 and 100 ng of botulinum toxin type A (Botox or Dysport [available in Europe]) or botulinum toxin type B (Myobloc) are used therapeutically to treat:
  - facial nerve disorders and to eliminate frown lines,
  - achalasia,
  - dysphagia, dystonia, torticollis, migraine headaches, spasticity,
  - voice and speech disorders (spasmodic dysphonia), and chronic anal fissures.



## ROUTE (IATROGENIC = THERAPEUTIC BOTULISM)

- Normally adverse effects are local but Systemic can occur on accidental over or mis dose
- Even proper doses can produce autonomic dysfunction without muscle weakness

# TOXIC DYNAMICS

WHY IS IT THE MOST DANGEROUS TOXIN IN THE WORLD?

LETHAL DOSE

0.1 mg – 0.01 mg – 0.00001 mg?

## LETHAL DOSE

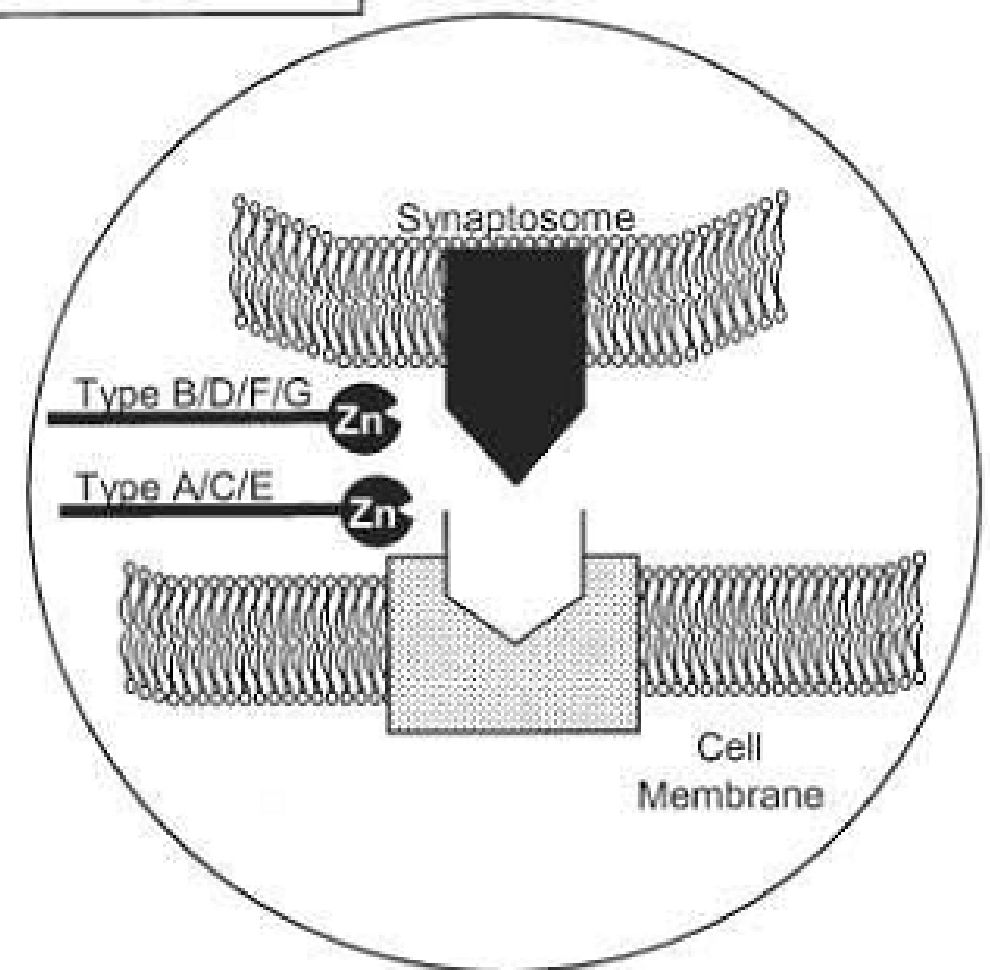
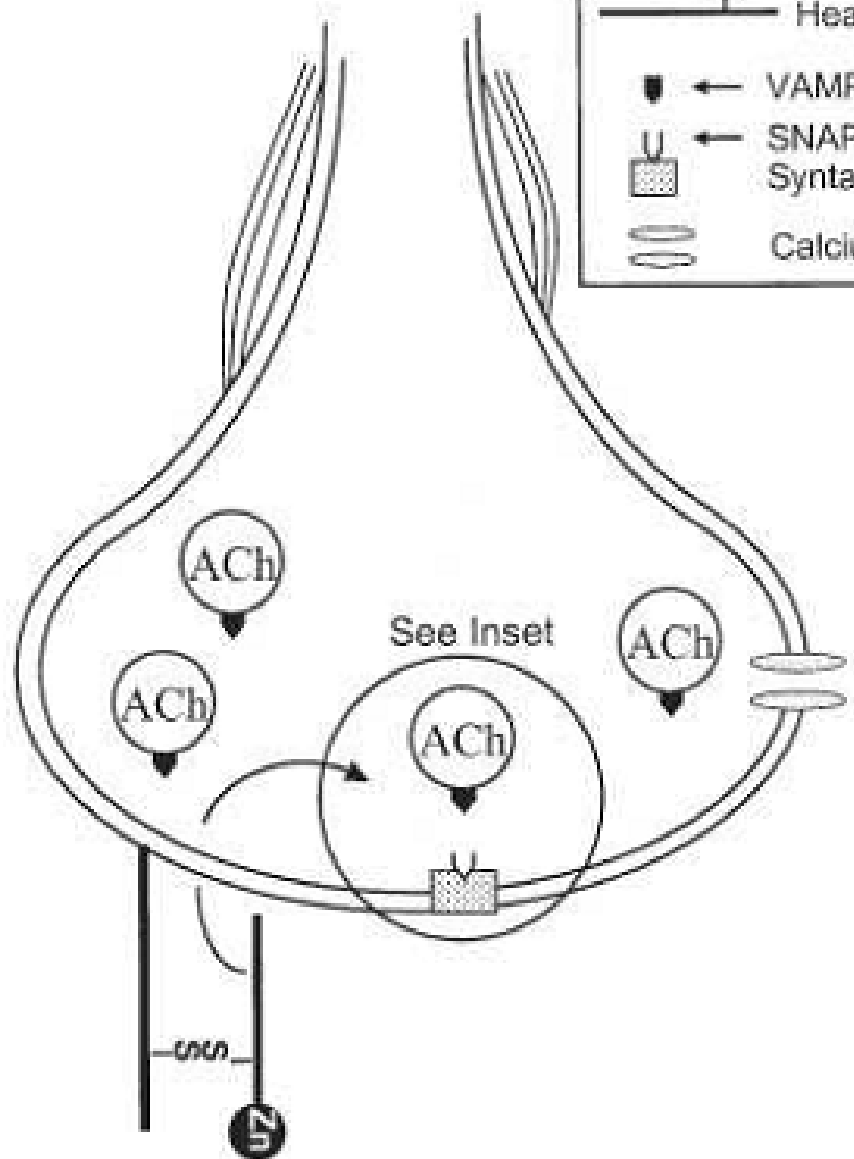
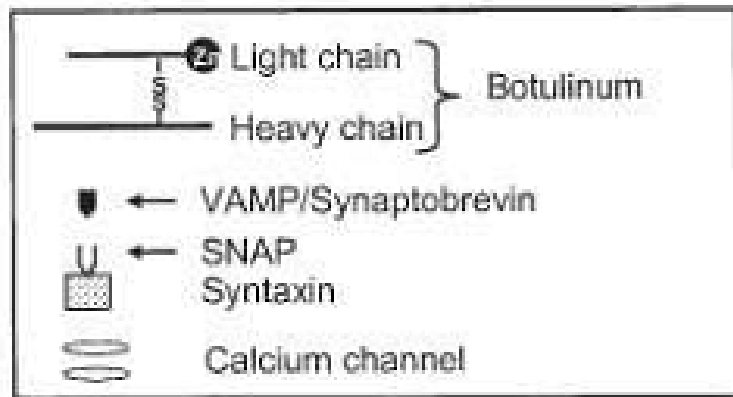
0.0000000000000001 mg/kg

- The lethal dose for human beings is just 1-2 mcg or 1 pg/kg.

Gm = 1000,000 mcg , Mcg = 1000,000 Pg

## MODE OF ACTION (NEUROTOXIN) – HOW DOES IT KILL?

- The botulinum toxin enters the preganglionic nerve terminal by endocytosis
- Binds rapidly (**and irreversibly**) to the cell membrane.



# MODE OF ACTION (NEUROTOXIN) – HOW DOES IT KILL?

- ↓ acetyl choline release
- ↓ presynaptic function → ↓ nerve transmission at all acetylcholine-dependent synapses in the PNS.

## INCUBATION PERIOD - HOW LONG DOES IT TAKE?

- Potent but slow.
- Incubation period:
  - About 12 to 36 hours (but can be as early as 3 hours and as late as 16 days).
  - Type E toxin has the shortest, and type B toxin the longest
  - In general, the earlier the onset of symptoms, the more serious the disease



HOW TO KNOW IT IS A BOTULISM?

## CLINICAL PICTURE (INITIAL PHASE)

- Subtle (Can go unnoticed or misdiagnosed).
- Nausea, vomiting, thirst, abdominal pain ,  
constipation

# CLINICAL PICTURE (NEUROLOGICAL PHASE)

Bilaterally symmetrical descending motor paralysis

1<sup>st</sup> Eyes

starts by eye muscles (abducent 6 VI or oculomotor 3 III nerve palsy) →

Ptosis

Difficulty with visual accommodation,

photophobia,

Pupil dilatation (sometimes fixed),

Diplopia (due to ocular paresis).

Strabismus and nystagmus have also been reported.

Dryness of lacrimal secretions

triad of extra ocular muscle palsy, pupillary dysfunction, and ptosis = severe illness (RF happen)

## CLINICAL PICTURE (NEUROLOGICAL PHASE)

Bilaterally symmetrical descending motor paralysis

2<sup>nd</sup> mouth – pharynx - larynx

- Dry mouth (not relieved by drinking fluids), soreness of throat due to drying of pharynx.
- Dysphonia, dysarthria, dysphagia.

## CLINICAL PICTURE (NEUROLOGICAL PHASE)

Bilaterally symmetrical descending motor paralysis

3<sup>rd</sup> respiratory system

- Respiratory muscle paralysis → Respiratory failure
- Could be sudden.
- Could persist up to year

## CLINICAL PICTURE (NOS)

- Mental status, sensory examination, reflexes, body temperature, and pulse are all usually normal.

## CLINICAL PICTURE (INFANTILE BOTULISM)

- Is said to be the commonest form of botulism.
- Symptoms: constipation, feeding difficulty, feeble crying, and  
Signs:
  - Loss of facial grimacing
  - A “floppy” baby with decreased muscle tone, particularly of the neck and limbs.
  - Ophthalmoplegia,
  - ↓ gag reflex,
  - poor anal sphincter tone
  - respiratory failure

## CLINICAL PICTURE (WOUND BOTULISM)

- This is a rare, life-threatening
- Happens in trauma deep wounds and complicated fractures and IV drug abuse.
- Clinical Features: fever + same as before



## CLINICAL PICTURE (DIFFERENTIAL DIAGNOSIS)

- Guillain Barré syndrome(Miller Fisher variant) (paralysis but normal pupil and fever)
- OPC poisoning (Respiratory distress but Salivation, lacrimation, urination, defecation, fasciculation, bronchorrhoea)
- Poliomyelitis (assymetrical and with Fever)

# INVESTIGATION

## 1) Searching for *C. botulinum*:

Samples: of serum, stool, vomitus, gastric contents, wound and suspected food items.

### Method:

A- Botulinum bacteria (selective media culture – sample is not needed to be refrigerated – within 18 hours of sampling)

B- Botulinum toxin (mouse bioassay lethal or non-lethal – sample needs to be refrigerated).

# INVESTIGATION

2) EMG: brief, small, abundant motor unit action potentials. (all forms of botulism). Motor nerve conduction velocity is normal

3) For DD: (myasthenia gravis) – tensilon test

Edrophonium: a rapid-acting anticholinesterase - 10 mg IV slowly (1 to 2 mg at first, then the rest over next 5 minutes). Muscle strength in myasthenia gravis will improve dramatically within ½ to 1 minute, and last for about 5 minutes but not in botulism.

Investigations or clinical  
picture?

# DIAGNOSIS

- 1) Clinical picture (do not wait for Labs):  
acute onset of: GIT + Autonomic + Cranial  
Nerve dysfunction
- 2) Laboratory

# HOW TO DEAL WITH A CASE OF BOTULISM? (MANAGEMENT)

MANAGEMENT

**P**revention

## PREVENTION OF BOTULISM

- Canned food: Avoid improperly preserved with any doubtful taste and odor avoid.
- Jams and jellies are safe (since their high sugar content will not encourage the growth of *Cl. botulinum*.)
- Boiling food for 10 minutes before eating destroys botulinum toxin.



# PREVENTION OF BOTULISM

To prevent germination of spores in food:

- the pH be  $<4.5$ , acidifying agents as citric or phosphoric acid
- NaCl content must be  $>3.5\%$ ,
- $\uparrow$  Nitrite level.

Prevention of infant botulism: Honey must not be given to infants

# SUPPORTIVE: A **B** <sub>CDE</sub>

- Any suspected patient needs to be hospitalized and monitored .
- All the focus is on A and B (vital capacity, peak expiratory flow rate, pulse oximetry, and gag reflex).
- Do not rely on ABG
- Assisted ventilation when needed. (VC<30% predicted)

# SUPPORTIVE

nutrition: oral feeds are contraindicated unless there is intact gag reflex.

antibiotics should only be used to treat complications such as respiratory or urinary tract infections, or wound infections.

prophylaxis: Stress ulcers , DVT prophylaxis and bed ulcers.

skincare: Paralytic ileus and nosocomial infections.

and rest: initially then ↑ activity gradually

## DECONTAMINATION

- GIT decontamination: AC, emesis , gastric lavage or catharsis (sorbitol is the choice) if the patient is seen early.
- Wound decontamination: Surgical debridement for suspected wounds

## SPECIFIC: ANTITOXIN (BOTULINUM ANTITOXIN)

- Trivalent (types A, B, and E)
- Not recommended for infants.
- Acts on the unbound toxin
- Sensitivity testing.
- IF there is sensitivity or history for allergy → desensitize

## SPECIFIC: ANTITOXIN (BOTULINUM ANTITOXIN)

- Best response is in 1<sup>st</sup> 24 hours
- Dose:
  - 1 vial - slow IV 100ml saline + 1 vial IM simultaneously. Then repeated IV every 2 to 4 hours, depending on the clinical status. (In foodborne botulism, additional doses usually are not required.)
  - 1 vial on diagnosis , 1 vial after 4 hours and 1 vial after 24 hours. All vials on 100 cc saline

## SPECIFIC: WOUND BOTULISM

- Penicillin: High dose IV benzyl penicillin
- Clindamycin and chloramphenicol are used as 2<sup>nd</sup> lines.

## SPECIFIC: OTHERS

- Human-derived botulism immune globulin (BIG): treat infant botulism. No risk of hypersensitivity
- Guanidine: controversial (many side effects and not recommended and Not present in Egypt)
- 4-aminopyridine (not present in Egypt)



## OUTCOME

- How many die?
- Main cause of death?

## OUTCOME

- Mortality is estimated to be  $< 10\%$  with symptomatic and supportive care. (higher in wound botulism than food borne botulism)
- Recovery: 30 – 100 days (may up to 7 months)

## OUTCOME

- Death: mainly from nosocomial infection (VAP) and Respiratory failure in delayed diagnosis.

## 3 Bs

- Botulinum bacteria & Botulinum toxin
- PNS & Paralysis
- Breathing & Botulinum antitoxin

## TAKE IT YOUR HOME

- Botulism is the most dangerous toxin all over the world **but yet slow**
- Botulism patient is saved **but support Ventilation**
- Botulism is fatal **but can easily be prevented**

THANKS