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A CRITICAL REVIEW ON BOTULISM POISONING

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ABSTRACT

Food poisoning includes all the illness which result from ingestion of food containing bacterial or non bacterial products. Botulism food poisioning includes in bacterial type of food poisioning which is caused by toxins produced by *clostridium botulinum* bacteria. There are certain food sources such as home canned foods provide a potent breeding grounds. There are 8 types of *Cl Botulinum*, type A is most potent toxin followed by type B & F toxin. Botulism can be spread in several ways, it may refer to food borne botulism, infant botulism, wound botulism & inhalation botulism or other types of intoxification. Food borne botulism caused by consumption of unproperly processed food which is a rare but potentially fatal diseases if not diagnosed rapidly. Botulism toxin blocks nerve function which can lead to respiratory and muscular paralysis. Prevention of food borne botulism can be managed by good practice in food preparation in respect to heating and hygiene. Inactivation of the bacterium and its spores is based on heating or sterlization of food. A botulism is usually treated with botulism antitoxin drug to fight the illness. There is a possibility of use of botulism toxins as biological weapon because of its extreme potency, lethality, ease of production and transport.

KEYWORDS:- *Cl. Botulinum*, Botulism, Food poisoning.

INTRODUCTION

Food borne illness are among encountered world-wide, and are particularly rampant in third world countries such as India. It is mainly due to relatives lack of sanitation and public hygiene.[1] The term food poisoning includes all illness as resulting from ingestion of foods

containing non – bacterial or bacterial products, viruses, environmental toxins or usually restricted to acute gastroenteritis due to the material infection of food or drink**.**

Botulism is one of the bacterial food poisoning. It is an intoxication not an infection. The causative agent is an anaerobic spore forming bacillus, *clostridium botulinum*, which produces an exotoxin. It is commonly found in the soil. The toxin is therefore, likely to be present in such soil contaminated undercooked food or canned food.[2] Botulism poisoning is due to a toxin produced by type of bacteria called *clostridium bacterium.* It is rare neuroparalytic diseases mediated by *botulinum* toxin. The toxin requires 24-72 hours to take effect, reflecting the time necessary disrupt the synaptosomal process. In very rare circumstances, some individuals may require as many as five days fo the full effect to observed. Peaking at about 10 days, the effect of botulism toxin lasts nearly 8-12 weeks.[3] In this article detail review on botulism poisoning is done.

Food poisoning[4]

Definition- The term food poisoning in its wider sense includes all illness which result from ingestion of food containing non-bacterial or bacterial products. But the term is usually restricted to acute gastroenteritis due to the bacterial infection of food or drink.

Who defines- Diseases usually either infectious or toxic in nature, caused by agent that enter the body through the ingestion of food.

Causes of food poisioning

1. Poisoning due bacterial, non-bacterial or toxins
2. Poisons of vegetables origin (natural food poison) i.e.

a. *Lathyrus sativus*
b. poisonous mushrooms
c. rye, oats, barley
d. poisonous berries (*Atropa Belladonna*)
e. *lolium temulentum*
f. *paspalam scorbiculatum*
g. *Argemone Mexicana*
h. Cotton seeds
i. Ground nuts
j. *Vitia fava*
k. Cabbage

l. *Solanine*
m. Soyabean
n. Sweet clover

3. Poisons of animal origin

a. Poisonous fish
b. Mussel

4. Chemical

a. Intentionally added flavoring agent in processed food, coloring agent, preservatives and extraction of fat by solvents like hydrocarbons.
b. Accidentally added like pesticides and insecticides
c. Products of food processing e.g. smoking of fleshy foods
d. Radionuclide.

Types of food poisoning[5]

A. Non-bacterial

1) Contained chemical Toxin
2) Plant food mixed with poison
3) Animal food mixed with poison.

B. Bacterial

1) Toxin type- Bacterial toxin by food
2) Infection type- By food mixed with viable organisms
3) Botulism- By Pathological view- classification is as follow-

a) Inflammatory
b) Non-inflammatory

Bacterial food poisoning[6] - Bacterial food Poisoning result from the ingestion of contaminated food, uncooked food or imperfectly cooked food. It is divided into two groups:

1. **Infection type (Inflammatory diarrhoea)**- Result from multiplication within the body of pathogenic organisms contained in the food. Organisms belong mainly to the salmonella group and occasionally organisms like *Proteus, E. Coli, Bacillus cereus, streptococci, shigella* and *paratyphoid bacilli* are also involved. *Salmonella* invade and destroy the mucosa of the small intestine.
2. **Toxin type (Non- Inflammatory Diarrhoea)-** Result from ingestion of preformed toxins (exotoxin) from bacterial proliferation in prepared food (canned or preserved food) e.g.

enterotoxin of *staphylococci*, *clostridium perfringens* or *Bacillus cereus*. The material usually affected are meat, fish or egg.

Botulism

The term botulism (*ALLANTIASIS*) is derived from "*botulismus*" meaning sausage. Botulism is an intoxication, not an infection. The causative organism *clostridium botulinum* (gram-positive spore forming anaerobic bacilli) multiples in the food, e.g.sausages, tinned meat, fish and fruits, before it is consumed and produces a powerful exotoxin- neurotoxin. Botulism toxin also called Miracle poison which is one of the most poisonous biological substances known.[7]

***Clostridium botulinum*[8]-** The genus *clostridium* consists of gram positive anaerobic spore forming bacilli which are responsible for three disease-

- Tetnus (Cl. Tetani)
- Gas gangrene (*Cl. Perfringes*, *Cl.septicum*, *Cl.novyi* etc.)
- Food poisoning (*Cl.botulinum*, *Cl.perfringens* Type A&C).

Types of *clostridium botulinum*

There are 8 types of *Cl.Botulinum*; A, B, C1, C2, D, E, F and G.[9] Type A is the mostpotent toxin followed by types *B & F* toxin. Types *A, B & E* are commonly associatedwith systemic Botulism in humans.[10]

Causes of botulism poisoning

The causative agent is an anaerobic spore forming bacillus *clostridium botulinum*, which produces an exotoxin. It is commonly found in the soil. The toxin is therefore likely to be present in such soil contaminated undercooked food or canned food. The food that are most often responsible are meat, fish or vegetable.[11]

Mode of action

The toxin paralyses the nerve ending by blocking the nerve impulses at the myoneural junctions. Its block the action of acetylcholine and its action is selective being confined to the cholinergic fibres of the autonomic nervous system.[12]

Mode of entry

Following are the modes of entry for botulinum toxin;

a) Food-borne botulism is caused by eating foods that contain the toxin.
b) Wound botulism is caused by toxin produced from a wound infected with *Clbotulinum*.
c) Infant botulism (intestinal botulism) is a caused by consuming the spores of thebotulinum bacteria (consumption of honey during the first year of life).which then grow in the intestines and release toxin.
d) Inhalation by laboratory workers and after cosmetic use.[13]

Incubation period

The incubation period varies from 12 to 30 hours, but may be prolonged to 72 hours.[14]

Fatal dose

The fatal dose for adult is 0.01 mg or even less.[15]

Fatal period

Death may occur within 24-48 hours or may be delayed for a week.[16]

Sign/Symptoms

- This is usually in humans by types A, B, E and rarely F. The initial phase of the disease is often so subtle as to go unnoticed or misdiagnosed.
- Ptosis, Difficulty with visual accommodation, mydriasis & diplopia (due to ocular paresis).
- Dysphonia, Dysphagia
- Bilaterally symmetrical descending motor paralysis, beginning with abducens(VI) or oculomotor (III) nerve palsy & progressing to respiratory insufficiency.
- Urinary retention
- Mental status, sensory examination, reflexes, body temperature & pulse are all usually normal.[17]
- The initial GI symptoms includes Difficulty in swallowing, Retching, Vomiting ‘colic pain, colic diarrhoea followed by constipation.[18]
- In those who survive, complete recovery of ocular movement may not take placefor 6 to 8 months. Mortality varies from 25 % to 100 %.[19]

Treatment[20]

- Due to the serious nature of the illness, all cases of botulism must be admitted tohospital & continuous monitoring done with reference to respiratory status (vital capacity, peak

expiratory flow rate, pulse oximetry & gag reflex). The moment signs of bulbar palsy begin to manifest, intubation or tracheostomy may have to be done.

- As the patient is seen early an attempt should be made to evaluate the GI tract of spores and toxin with help of activated charcoal, emesis, gastric lavage or catharsis. Presence of gag reflex must be ascertained. GUT decontamination is of course no applicable in wound botulism.
- **Botulism antitoxin-** Trivalent botulism antitoxin (type A, B & E) is enquine globulin preparation that is available in the west since the 1960s but does not appear to be produced in India.
- **Guanidine**- The use of guanidine is controversial since it has low efficacy and high incidence of adverse effects. In case it is considered appropriate, the recommended dose is 15 to 40 mg /kg/ day orally until EMG improvement occurs at least in the ocular muscles.
- **Penicillin-** It is of no use in food borne and infant botulism but can be of substantial benefit in wound botulism. Penicillin G is the preferred form.
- **Human-derived botulism immune globulin (BIG)-** has recently been introduced in the west to treat infant botulism. It is pentavalent (type A, B, C, D & E) immune globulin harvested by Plasmapheresis form donors who received multiple immunizations with pentavalent botulinum toxoid.
- **Supportive measures**;- Nutritional Supplementation - oral feeds are contraindicated unless there is intact is gag reflex .
- **Respiratory support**- Forms the mainstay of treatment.

Precaution/ Prevention[12]

- Avoid consuming improperly preserved home canned foods.
- Home- canning of vegetable should be done with a pressure cooker so as to attain temperatures necessary to kill botulism spores (above 100º C for 10 min.)
- Jams and jellies can be safely home - canned without pressure cooker, since their high sugar content will not encourage the growth of Cl. Botulinum.
- Cooked foods should not be kept at temperatures of 4ºC to 60 ºC for more than4 hours.
- To prevent germination of spores in food, the pH should be maintained at less than 4.5, the sodium chloride content must be more than 3.5% and nitrite level should be sufficiently high.

- Food contaminated by *Cl. Botulinum* types A and B often looks or smells abnormal due to action of proteolytic enzymes. If there is any doubt, the food item must be discarded.
- Food contaminated with type E toxin usually looks and smells normal.
- Prevention of infant botulism can be done by thoroughly washing foods and object that are placed in a child's mouth. Honey must be given to infants.

Differential diagnosis[22]

The common conditions confused with foodborne botulism are mentioned below.

S. No.	Condition	Key diagnostic feature
1	Anticholinergic syndrome	Mydriasis, drymucosa, fever, vasodilation, tachycardia, hypertension,ileus, altered mental Status
2	Carbon monoxide poisoning	Headache, nausea, tachypnoea, alteredsensorium, elevated carboxyphaemoglobin
3	Diphtheria	Exudative pharyngitis, cranial polyneuropathy, hypotension, cardiac features.
4	Elapid Snake Bite	Vertigo, weakness, nausea, salivation,vomiting, fasciculations, tremor, followed by bulbar palsy with slurred speech,diplopia, ptosis, dysphagia, dyspnoea &Respiratory failure
5	Encephalitis	Fever, convulsions, altered mental statis,elevated CSF protein, pleocytosis
6	Guillian-barre-syndrome (Miller-fisher variant)	Fever, opthalmoplegia, Descendingparalysis, absent deep tendon reflexes,ataxia, sensory paraesthesias, elevated CSF protein
7	Inflammatory myelopathies	Complete or incomplete spinal syndrome, posterior column myelopathywith asending paraesthesias, ascendingspinothalamic finding, or brown-sequardsyndrome. Usually follow viral illness, with bacl pain, progressive paresis, asymmetric ascending paraesthesias in legs, CSF: 5 to 50 lymphocytes/mm3
8	Multiple Sclerosis	Weakness, visual blurring. Sensory disturbances, ataxia, mononuclear cell pleocytosis in CSF, evoked response testing: abnormalconduction in visual. Auditory, somatosensory or motor pathways abnormal MRI or CT
9	Myasthenia gravis	Aggravation of fatigue with exercise,positive tension test
10	Organophosphate poisoning	Sallivation, lacrimation, urination,defaecation, fasciculations,bronchorroea
11	Paralytic shelfish poisoning	Dysaesthesias, paraesthesias, impaired mentation, respiratory paralysis
12	poliomyelitis	Fever, GI symptoms, asymmetric neurological findings, CSF pleocytosis
13	Tetanus	Cranial nerve defects, spasticity, rigidity

14	Tick paralysis	Focal findings, large muscle weakness, ascending paralysis

Post-Mortem appearance

The pathological changes consist of congestion and haemorrhage in all organs & especially in the central nervous System. Degenerative changes occur in Kidneys, liver.[23] Histological examination of the organs may show thrombosis.[24] Hyperaemia of the alimentary tract. The bacillus may be isolated from the stomach content, liver, spleen and intestinal content after death.[25]

Medico-legal Importance[26]

Unintended outbreak of food- borne botulism is caused from foods that are not canned properly or improper handling during manufacturing. Latrogenic botulism can also occur from accidental overdose of botulism toxin. Cosmetic or therapeutic use may result in adverse events resulting in lawsuits alleging negligence (complication such as immune reaction and brain injury may occur). Botulism toxin poses a major biological weapon because of its extreme potency, lethality, ease of production and transport. Dissemination of aerosols of toxin can produce mass casualties.

CONCLUSION

Botulism food poisoning differs the types, there are no symptoms of gastroenteritis. Although poisoning results from absorption of a specific toxin from the alimentary canal. It is a rare but serious and life threatening condition caused by a toxin that attacks the body nerves. All forms of botulism like food borne botulism, wound botulism, infant botulism and latrogenic botulism can be fatal and are considered medical emegencies. Hence it is important to use proper techniques when canning orpreserving food to make sure botulism germs destroyed.

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