



A REVIEW ARTICLE ON FOOD POISONING

*¹Dr. Jagdish Kumar Anant, ²Dr. S.R. Inchulkar, ³Dr. Sangeeta Bhagat

¹PG Scholar, ²Professor & HOD, ³Assistant Professor,
P.G. Department of Agad Tantra Evam Vidhi Vaidyak, Govt. Ayurvedic College, Raipur, Chhattisgarh India.

***Corresponding Author: Dr. Jagdish Kumar Anant**

PG Scholar P.G. Department of Agad Tantra Evam Vidhi Vaidyak, Govt. Ayurvedic College, Raipur, Chhattisgarh India.

Article Received on 17/07/2018

Article Revised on 07/08/2018

Article Accepted on 28/08/2018

ABSTRACT

Food borne illnesses are the commonest health problems encountered world-wide, and are particularly rampant in Third World countries such as India, mainly due to a relative lack of sanitation and public hygiene. The term food poisoning in its wider sense includes all illnesses which result from ingestion of food containing non-bacterial or bacterial products. In other words, it is an acute gastroenteritis caused by ingestion of food or drink contaminated with either living bacteria or their toxins or chemical substances and poisons derived from plants and animals. Acute gastroenteritis is a major cause of morbidity and mortality. Infants and young children are particularly at risk. The majority of episodes may be directly linked to infection or infectious agents spread by the faecal-oral route and transmitted either on fomites, on contaminated hands, or in food or water. The clinical features of food borne infection is dependent on the pathogenic mechanisms involved. The chief symptoms are headache, giddiness, intense thirst, acute vomiting, diarrhea, colicky pain, cold and clammy skin, slow pulse, rigors and cramps. Measures such as the provision of clean potable water, appropriate disposal of human and animal sewage with separation from water supplies, and simple principles of food hygiene are all very effective means of halting the spread of these infections. Fluid replacement, ideally oral, is vital in the management of these cases.

KEYWORDS: Food, Bacteria, Toxin, Food Borne Intoxication, Management, Medicolegal Aspect, etc.

INTRODUCTION

Food poisoning means illness resulting from ingestion of food with microbial or non-microbial contamination.^[1]

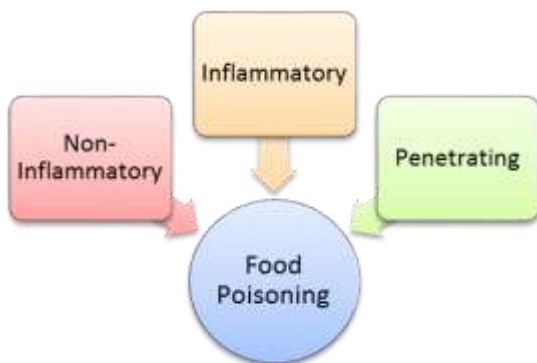
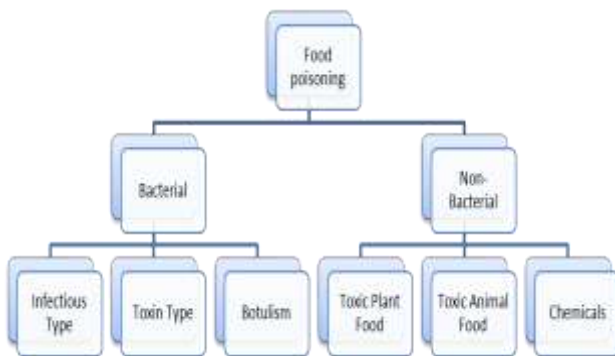
The condition is characterized by (a) history of ingestion of a common food (b) attack of many persons at the same time, and (c) similarity of signs and symptoms in the majority of cases.^[2] The World Health Organization estimates that there are more than 1000 million cases of acute diarrhea annually in developing countries, with 3-4 million deaths.^[3] According to the Food Standards Agency (FSA) there are nearly 900000 cases of food poisoning each year. Our lifestyles have changed over the last few years which include an increasing reliance on ready prepared meals, eating out rather than cooking and taking more holidays abroad. We all lead busy lives and as a result of that tend to spend less time preparing and cooking food. People often cook several meals in advance and freeze them for a long period of time or buy convenience food which only has to be put in a microwave oven. This is the reason for increasing food poisoning cases in present scenario. Knowing where your food is sourced from and the standards of care and safety that have been applied may help to reduce the incidences of food poisoning.^[4]

Causes Of Food Poisoning.^[1]

- A. Microbial Contamination
 1. Bacteria
 - Bacillus cereus
 - Staphylococcus aureus
 - Salmonella group (except S. typhi)
 - Shigella
 - Vibrio
 - Escherichia coli
 - Campylobacter
 - Yersinia enterocolitis
 - Clostridium
 2. Viruses
 - Rotavirus
 - Adenovirus
 - Parvovirus
 3. Protozoa
 - Giardia lamblia
 4. Fungi
 - Aspergillus flavus
 - Fusarium roseum
- B. Nonmicrobial Contamination
 1. Vegetable origin

- Lathyrus sativus
 - Mushrooms
 - Argemone Mexicana
2. Animal sources
 - Poisonous fish like shell fish, scombroid fish etc.
 - Mussel
 3. Chemicals
 - Flavoring agents
 - Coloring agents
 - Preservatives

Classification of Food Poisoning.^[5,6,7]



Factors Leading To Food Poisoning^[8]

Enteric pathogens have developed a variety of tactics to overcome host defenses. Understanding the virulence factors employed by these organisms is important in the diagnosis and treatment of clinical disease.

1. **Inoculum size:** The number of microorganisms that must be ingested to cause disease varies considerably from species to species. For Shigella, enterohemorrhagic Escherichia coli, Giardia lamblia, or Entamoeba, as few as 10-100 bacteria or cysts can produce infection, while 10^5 - 10^8 Vibrio cholerae organisms must be ingested orally to cause disease.
2. **Adherence:** Many organisms must adhere to the gastrointestinal mucosa as an initial step in the pathogenic process; thus, organisms that can compete with the normal bowel flora and colonize the mucosa have an important advantage in causing disease.

3. **Toxin Production:** The production of one or more exotoxins is important in the pathogenesis of numerous enteric organisms. Such toxins include enterotoxins, which cause watery diarrhea by acting directly on secretory mechanisms in the intestinal mucosa; cytotoxins, which cause destruction of mucosal cells and associated inflammatory diarrhea; and neurotoxins, which act directly on the central or peripheral nervous system.
4. **Invasion:** Dysentery may result not only from the production of cytotoxins but also from bacterial invasion and destruction of intestinal mucosal cells. Infections due to Shigella and enteroinvasive E. coli are characterized by the organisms' invasion of mucosal epithelial cells, intraepithelial multiplication, and subsequent spread to adjacent cells.
5. **Host Defenses:** Normal host can protect itself against disease. Food poisoning depends upon host defense mechanisms e.g. Normal flora, Gastric acid, Intestinal motility, Immunity and Genetic determinants.

Gastrointestinal Pathogens Causing Acute Diarrhea.^[9]

S. N.	Mechanism	Location	Illness	Stool Findings	Pathogen Involved
01	Non-Inflammatory (Enterotoxin)	Proximal small bowel	Watery Diarrhea	No fecal leukocytes; mild or no increase in fecal lactoferrin	Vibrio cholera, Enterotoxigenic Escherichia coli, enteroaggregative E. coli, Clostridium perfringens, Bacillus cereus, Staphylococcus aureus, Aeromonas hydrophila, Plesiomonas shigelloides, rotavirus, norovirus, enteric adenoviruses, Giardia lamblia, Cryptosporidium spp., Cyclospora spp., microsporidia
02	Inflammatory (Invasion or Cytotoxic)	Colon or distal small bowel	Dysentery or inflammatory Diarrhea	Fecal polymorpho-nuclear leukocytes; substantial increase in fecal lactoferrin	Shigella spp., Salmonella spp., Campylobacter jejuni, Enterohemorrhagic E. coli, Enteroinvasive E. coli, Yersinia enterocolitica, Listeria monocytogenes, Vibrio parahaemolyticus, Clostridium difficile, A. hydrophila, P. shigelloides, Entamoeba histolytica, Klebsiella oxytoca.
03	Penetrating	Distal small bowel	Enteric fever	Fecal mononuclear leukocytes	Salmonella typhi, Y. enterocolitica

Clinical Feature of Specific Bacteria And Food Poisoning.^[10]

S. N.	Organism	Incubation	Signs & Symptoms	Source
01	Staphylococcus aureus	1-6 H	Nausea, vomiting, diarrhea	Ham, poultry, potato or egg salad, mayonnaise, cream pastries
02	Bacillus cereus	1-6 H	Nausea, vomiting, diarrhea	Fried rice
03	Clostridium perfringens	8-16 H	Abdominal cramps, diarrhea, vomiting rare	Beef, poultry, legumes, gravies
04	B. cereus	8-16 H	Abdominal cramps, diarrhea, vomiting rare	Meats, vegetables, dried beans, cereals
05	Vibrio cholerae	> 16 H	Watery diarrhea	Shellfish
06	Enterotoxigenic E. coli	> 16 H	Watery diarrhea	Salads, cheese, meats, water
07	Enterohemorrhagic E. coli	> 16 H	Bloody diarrhea	Ground beef, roast beef, raw milk, raw vegetables, apple juice
08	Salmonella spp.	> 16 H	Inflammatory diarrhea	Beef, poultry, eggs, dairy products
09	Campylobacter jejuni	> 16 H	Inflammatory diarrhea	Poultry, raw milk
10	Shigella spp.	> 16 H	Dysentery	Potato or egg salad, lettuce, raw vegetables
11	Vibrio parahaemolyticus	> 16 H	Dysentery	Mollusks, crustaceans

**Diagnostic Approach.**^[11,12,13]

Diagnosis is generally clinical but can be made by isolating the bacteria from the vomit, urine or faeces and

the suspected foods, or from the bowels and solids organs of the sufferer after death, and identifying them by cultural characteristic and agglutination tests. The main diagnosis criteria of food poisoning

- History
- Clinical picture
- Stool analysis
- Suspect food / agent analysis
- Measurement of serum electrolytes

Complications.^[14]

S.N.	Complication	Comments
01	Chronic diarrhea <ul style="list-style-type: none"> • Lactase deficiency • Small-bowel bacterial overgrowth • Malabsorption syndrome (tropical and celiac sprue) 	Occurs in ~ 1% of travelers with acute diarrhea <ul style="list-style-type: none"> • Protozoa account for ~ 1/3 of cases
02	Initial presentation or exacerbation of inflammatory bowel disease	May be precipitated by traveler's diarrhea
03	Irritable bowel syndrome	Occurs in ~ 10% of travelers with traveler's diarrhea
04	Reactive arthritis (formerly known as Reiter's syndrome)	Particularly likely after infection with invasive organisms (Shigella, Salmonella, ompylobacter, Yersinia)
05	Hemolytic-uremic syndrome (hemolytic anemia, thrombocytopenia, and renal failure)	Follow infection with Shiga toxin-producing bacteria (Shigella dysentery type 1 and Enterohemorrhagic Escherichia coli)
06	Guillain-Barre syndrome	Particularly likely after Campylobacter infection

General Principles of Treatment^[15]**1. Oral Rehydration Therapy (ORT)**

- This is resorted to only in the presence of mild dehydration (3 to 5% fluid deficit), or moderate dehydration (6 to 10% fluid deficit).
- Rehydration should commence with a fluid containing 50 to 90 mEq/L of sodium. The amount of fluid administered should be 50 mL/kg over a period of 2 to 4 hours in mild dehydration, and 100 mL/kg in moderate dehydration. After 2 to 4 hours, hydration status should be assessed and if found to be normal, maintenance therapy can be begun, otherwise rehydration therapy is repeated.
- Maintenance therapy: Oral rehydration solution (ORS) should be administered as follows:
 - 1 mL for each gram of diarrheal stool
 - 10 mL/kg for every watery stool passed
 - 2 mL/kg for each episode of vomiting.
- Limitations of ORT: ORT is not sufficient therapy in the presence of dysentery (bloody diarrhea), shock, intestinal ileus, intractable vomiting, high stool output (> 10 mL/kg/hr), monosaccharide malabsorption, and lactose intolerance.

2. Intravenous Rehydration

- This is necessary when dehydration is severe (> 10% fluid deficit or shock).
- 20 mL/kg boluses of ringer's lactate, normal saline, or similar solution is administered until pulse, perfusion, and mental status return to normal.
- Two separate IV lines may be required, or even alternative access sites such as femoral vein, venous cut-down, or intra-osseous infusion.
- Oral rehydration is commenced when condition improves.

3. Non-specific Antidiarrheal Agents

- Use of agents such as kaolin-pectin, antimotility drugs (e.g., loperamide), antisecretory drugs, or

toxin binders (e.g., cholestyramine), is controversial. Available data do not demonstrate significant beneficial effects. Instead, serious adverse effects can occur, including ileus and anticholinergic syndrome.

Prevention^[15]**1. 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 pasteurized milk or cheese.
- Do not buy eggs which are cracked or leaking.

2. 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.
- Purchased hot foods should be eaten immediately, or kept hot (> 60°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.

3. Temperature requirements

- Never leave cut vegetables or meat in the open. Store them in the refrigerator 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 thoroughly until both the yolk and white are firm. Never eat runny yolk.

- e) Reheat food or heat partially cooked foods all the way through at least 74°C.
- f) If any food item looks or smells suspicious, discard it.

4. Hygiene

- a) Wash hands, utensils, counters, and cutting surfaces with water and soap between preparation of different foods (especially in the case of raw meat, poultry, or fish).
- b) Use plastic or glass cutting boards for slicing vegetables or meat. Wooden boards are extremely difficult to clean adequately.
- c) Wash fresh fruits and vegetables under running water.

5. Dining out

- a) Avoid consuming uncooked animal-derived dishes (sushi, raw oysters, eggnog, mayonnaise, etc).
- b) Do not eat undercooked meat or poultry.
- c) Do not consume egg preparations with runny yolk.

6. Foreign travel

- a) Drink only boiled or bottled water.
- b) Do not eat raw vegetables and salads.
- c) Do not buy food items from roadside vendors.

Control^[16]

When there is a report of case(s), of food poisoning, the remains of food, empty containers, stools and vomit should be seized and sent immediately in an ice box for bacteriological and chemical examination. Organs removed after postmortem may be sent in 30 percent glycerin solution. It is necessary to trace the source of contamination and to deal with it properly. The containers used for cooking the suspected food should be disinfected and the remaining food should be destroyed.

Tracing the Source of Infection^[16]

- a) Find the extent of the outbreak, i.e. the total number of person who took the food and of those who suffered.
- b) Study the clinical picture of each case. Make a special note of the nature of onset, incubation period and involvement of nervous system, if any.
- c) Trace the evidence implicating a particular food. Note the time of the last meal and ascertain the persons who developed symptoms or remained symptom free after consuming a particular item of food.
- d) Confirm the nature of toxic agent on the basis of chemical, bacteriological and postmortem reports.
- e) Investigate the source of infection, the means of contamination and the circumstances responsible for the same during storage.
- f) Assessment of environmental factors: kitchen, dining hall, storage of food grains and cooked food, presence of rodents.

- g) Record the history of any illness among food handlers and examine their stools, urine and blood for carrier state.
- h) Laboratory report: vomitus, stool of patients for culture, sample of suspected food, serological test of blood for antibody titre.
- i) Draw conclusions and make appropriate recommendations.

Postmortem Findings.^[17,18]

- a) The mucosa of the GIT is swollen and often intensely congested, and there may be minute ulcers.
- b) Microscopic examination shows fatty degeneration of the liver.
- c) The causative organism can be isolated from the blood and viscera.

Medicolegal Aspect.^[19,20]

Information to Public Health Authorities

Doctor must inform all cases of food poisoning to public health authorities, as well as to police, because such cases are liable to be registered u/s **269, IPC** (negligent act likely to spread infection dangerous to life), **272, IPC** (Adulteration of food or drink intended for sale) and **284, IPC** (negligent conduct with respect to poisonous substance).

- **Accidental:** Mass food poisoning is not uncommon in India and usually occurs during function or celebration, when food is served to a number of guests. Contamination may be result from unhygienic measure during the preparation or storage of articles of food.
- **Homicidal:** Isolated case of food poisoning may have medico-legal importance as one can deliberate addition of culture of micro-organism in the food of a homicidal intent.
- **Suicidal:** It is nearly impossible.

CONCLUSION

Food borne intoxications are the most wide spread global public health problem in present scenario. An incident of food poisoning will cause serious financial loss, sometimes resulting in business closure, bankruptcy, and loss of work. However, the true incidence of food borne illnesses are unknown for the many reasons, including poor responses from affected person during visiting the health officials, misdiagnosis of the illness, improper collection of samples for laboratory analysis and improper laboratory examination. So there is a need to implement strict food safety laws. These laws are enforced by food inspectors and environmental health officers. Food inspectors can at any time enter a place where food is being prepared. They will inspect the food and can take away samples for testing. Premises found to be unfit can be closed, persons found guilty of breaking the laws can be fined, imprisoned, customers suffering from food poisoning can claim financial compensation.

REFERENCES

1. Rajesh Bardale, Principles of Forensic Medicine & Toxicology 2nd edition-, Jaypee Brothers Medical Publishers (P) Ltd New Delhi-110002, 2017; 606.
2. K. Park, Park's Textbook of Preventive and Social Medicine 24th edition-2017, M/s Banarsidas Bhanot Publisher Jabalpur-482001 (India), 253.
3. Stanley Davidson, Davidsons Principles and Practice of medicine 20th reprint edition, Churchill Livingstone Elsevier Publisher USA, 2008; 294.
4. Parashnath M, Indranil C, Food Poisoning: Illness Ranges from Relatively Mild through to Life Threatening, Journal of Medical and Health Sciences, 2016; 1.
5. Sharad Porte, Agadtantra Vish Chikitsa Vigyan 1st edition, Ayurved Sanskrit Hindi Pustak Bhandar Jaipur-302001, 2016; 95.
6. S. K. Singhal Singhal's Toxicology at a Glance 9th reprint edition- The National Book Depot Mumbai-400012, 2017; 140.
7. Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology 17th reprint edition, CBS Publishers & Distributors P. Ltd New Delhi-110002, 2014; 587.
8. Harrisons Principles of Internal Medicine volume-1, 18th edition, Publisher McGraw-Hill's Professional Publishing, 2011; 1084-1085.
9. Harrisons Principles of Internal Medicine volume-1, 18th edition, Publisher McGraw-Hill's Professional Publishing, 2011; 1084.
10. Sharad Porte, Agadtantra Vish Chikitsa Vigyan 1st edition, Ayurved Sanskrit Hindi Pustak Bhandar Jaipur-302001, 2016; 97.
11. Jaising P Modi, Modi A Textbook of Medical Jurisprudence and Toxicology 26th edition, Lexis Nexis publication Gurgaon-12202, Haryana, 2018; 208.
12. V V Pillay, Textbook of Forensic Medicine & Toxicology 18th edition, Paras Medical Publisher Hyderabad-500095, 2017; 711.
13. K. S. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology 34th edition, Jaypee Brothers Medical Publishers (P) Ltd New Delhi-110002, 2017; 590.
14. Harrisons Principles of Internal Medicine volume-1, 18th edition, Publisher McGraw-Hill's Professional Publishing, 2011; 1087.
15. V V Pillay, Textbook of Forensic Medicine & Toxicology 18th edition, Paras Medical Publisher Hyderabad-500095, 2017; 711-712.
16. Mahajan & Gupta, Textbook of Preventive and Social Medicine 4th edition, Jaypee Brothers Medical Publishers (P) Ltd New Delhi-110002, 2013; 230.
17. Gautam Biswas, Review of Forensic Medicine and Toxicology 3rd edition, Jaypee Brothers Medical Publishers (P) Ltd New Delhi-110002, 2015; 630.
18. Jaising P Modi, Modi A Textbook of Medical Jurisprudence and Toxicology 26th edition, Lexis Nexis publication Gurgaon-12202, Haryana, 2018; 208.
19. Sharad Porte, Agadtantra Vish Chikitsa Vigyan 1st edition, Ayurved Sanskrit Hindi Pustak Bhandar Jaipur-302001, 2016; 99.
20. Anil Aggrawal Forensic Medicine and Toxicology for MBBS 1st edition, Avichal Publishing Company Sirmour-173030, (HP), 2016; 557.