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GASTROENTEROLOGY

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1st lecture

Diarrhea

It is the second most common cause of child deaths worldwide. It is defined as increased total daily stool output to be >10gm/kg/day or more than adult limit> 200gm /day associated with increased water content. In practice, this usually means having loose or watery stools more than 3 times a day.

Normally, there is bidirectional flow of fluid in the wall of the intestine, there is absorption of water & electrolytes at the tip & wall of the villous of small intestine, while their secretion at the base of the crypts.

Mechanism of Diarrhea

PRIMARY MECHANISM	PATHOPHYSIOLOGY	STOOL EXAMINATION	EXAMPLES	COMMENT
Secretory D.	Active electrolyte and water fluxes toward the intestinal lumen, by increasing of intracellular cAMP & cGMP or calcium in response to microbial enterotoxins	Usually massive, Watery, no stool leukocytes or RBCs	Cholera, toxigenic *E. coli;* carcinoid, neuroblastoma,	Persists during fasting.
Osmotic D.	Caused by intraluminal non absorbed solutes drives water passively into the intestinal lumen.	Watery, acidic (pH less than 5.6) stool, presence of reducing substances, no stool leukocytes or RBCs	Lactase deficiency, lactulose intake. Toddler diarrhea.	Stops with fasting or stopping of ingested substance.
Mucosal invasion	Inflammation, decreased colonic reabsorption, increased motility	Dysentery (blood), mucus, and WBCs	*Salmonella, Shigella*; amebiasis; *Yersinia, Campylobacter*	Unrelated to fasting
Increased motility	Decreased transit time so reduce the time for absorption.	stimulated by gastrocolic reflex	Irritable bowel syndrome, thyrotoxicosis.	Infection may also contribute to increased motility
Decreased motility	Stasis leading bacterial overgrowth		Pseudoobstruction, blind loop	
Decreased	Decreased functional		Short bowel	

PRIMARY MECHANISM	PATHOPHYSIOLOGY	STOOL EXAMINATION	EXAMPLES	COMMENT
surface area	capacity		syndrome, celiac disease, rotavirus enteritis, surgical resection.	
Adherence to the mucosa	By decreasing the absorpative area of intestine		Giardiasis, entero-adherant E. Coli.	
mixed				

Biochemical Changes of Diarrhea +/- Vomiting

- **Diarrhea** leads to loss of water, NaCls, KCl, bicarbonate, & loss of calories.
- **Vomiting** leads to loss of water, NaCls, KCl, acid, & loss of calories.

In case of both diarrhea & vomiting lead to dehydration, electrolyte imbalance, metabolic acidosis, & malnutrition.

- **Dehydration** lead to collapse of intravascular volume, hypotension, shock, acidosis, oliguria, acute renal shutdown, & hemoconscentration & renal vein, intracranial, or other intravascular thrombosis.
- **Acidosis** occur with diarrhea due to loss of bicarbonate in the stool, starvation lactic acidosis, tissue hypoxia lactic acidosis, impaired renal perfusion.
- **Electrolyte imbalance:**

. Hypokalemia led to impaired cardiac function, hypotonia, & paralytic ileus.
. Hyponatremia, hypernatremia may lead to convulsion.

Types of Diarrhea

Acute diarrhea: diarrhea that continues for less than 2 weeks.
Chronic diarrhea: diarrhea that lasts for more than 14 days.
Persistent diarrhea: Gastroenteritis that began acute diarrhea, but lasts for 14 or more days. Persistent diarrhea belongs to chronic diarrhea.
Dysentery: diarrhea with visible blood in the stool.

ACUTE GASTROENTERITIS

It causes one billion illness & 2- 5 million deaths per year. Rotavirus (the most common identifiable viral cause of gastroenteritis in all children) accounts for 197,000 deaths annually or 28% of all deaths caused by diarrhea among children younger than 5 yr of age.

Transmission is by feco- oral route or direct person to person. More common in babies of less than 2 yr old & in bottle fed infants & more severe is under 6 months of age.

More common at summer because of increased multiplication at increased temperature, increased water intake, increased fruit & vegetable intake with swimming at pools & river.

Usual clinical manifestations are: Diarrhea (usually watery) may be associated with vomiting, abdominal cramps, fever, malaise, abdominal distension, & dehydration.

Causes

Bacteria: It is considerable when fever>38.5c & the diarrhea is severe and may be bloody. Causative bacteria are Salmonella, Shigella, E. coli, V. cholera, Staph auras, Clostridia, Compylobacter, Yersinia, & others.

Extraintestinal infections following bacterial invasion may cause meningitis, endocarditis, UTI, vulvovaginitis, pneumonia, peritonitis, hepatitis, septic arthritis, ostiomyelitis, & sepsis.

Viruses: Fever is usually <38.5c & diarrhea is usually watery &not sever, the possibility is higher with preceding or associated viral respiratory tract infection, in winter season& when more than one member of the family is simultaneously affected. Causative viruses are Rota, calcivirus, norovirus, sapoviruses, adenovirus,… others.

Parasites: Giardia & E. histolytica.

Entamoeba histolytica: the diarrhea is commonly bloody & associated with tenesmus, but fever usually mild or absent. Treatment with metronidazole (30-50mg/kg/day for 10 days) followed by diloxanide furuate (cyst killer).

Giardia Lamblia infection: the diarrhea is usually watery, foul smelling, & associated with abdominal distention, no fever.

Treatment

- The most important step is treatment of dehydration.
- Antibiotics are indicated only in special cases & supported by the culture.
- Anti- diarrheal drugs like pectin, kaolin, or diphenoxylate are not useful & may aggravate the condition.

PERSISTENT DIARRHEA

Persistent diarrhea accounts for 3-19% of all diarrheal episodes in children younger than 5 yr of age and up to 50% of all diarrhea-related deaths.

Causes

Shigella, Salmonella, enteroaggragative E. coli, enteropathogenic E. Coli, Cryptosporidium (especially in malnourished & immunocompromised patients), & Giardia & E. histolytica.

It causes extensive changes in the small bowel mucosa by damaging of the villi so reducing secretion of dissachridase & enterokinase enzymes leading to malabsorption & then malnutrition, which by itself will lead to 2ndery immune deficiency, so persisting the infection & diarrhea. This cycle if not stopped, it will lead to death.

Risk factors for persistent diarrhea:

- Malnutrition.
- Young children: more common in less than 18 months old.
- Immunological impairment: as in measles, AIDS, or primary immune deficiency.
- Previous history of persistent diarrhea.
- Hypersensitivity to cow milk protein.
- Lactose intolerance.

Investigation

- GSE: macro- & microscopical examination for RBC, pus cells, cysts, trophozoite, in addition to stool pH & reducing substance.

- Stool culture & sensitivity.

- WBC count & differential.

- Serum electrolytes.

- Blood urea.

- Specific tests for AIDS, immunoglobulin assay, etc…. if indicated.

Treatment

- Treat dehydration.
- Antibiotics according to culture & sensitivity.
- Nutritional therapy: by:

  . Temporarily reduce the amount of animal milk & lactose in the diet.

  . Provide sufficient protein & full energy intake (with frequent small meals containing cereals, add vegetable oil, meats) with vitamins & minerals, & then iron to enhance repair of the damaged& to correct malnutrition.

  . Avoid giving foods & drinks aggravates the diarrhea.

CHRONIC DIARRHEA

It is usually semi liquid or watery in consistency.

Causes

- Parenteral diarrhea : UTI, otitis media, others.
- Dietary factors: over feeding, cow milk & soy protein intolerance,
- Severe malnutrition
- Carbohydrate malabsorption:

  Congenital: congenital sucarase – isomaltase deficiency.

  Congenital glucose- galactose malabsorption.

  Acquired: acquired lactose intolerance.

- Irritable bowel syndrome.
- Celiac disease.
- Inflammatory bowel disease: Crohns & Ulcerative colitis
- Acrodermatitis enteropathica.
- Abetlipoprotinemia.
- GIT anomaly: e.g. short bowel syndrome.
- Congenital cause started at neonatal period (microvillus inclusion disease, congenital chloride diarrhea, congenital sodium diarrhea,……etc.).
- Pancreatic disorders: cystic fibrosis.
- Liver disorders: chronic cholestasis.
- Endocrinopathies: e.g. thyrotoxicosis
- Functional tumors as carcinoid tumor, neuroblastoma
- Chemotherapy or radiation.
- Drugs: e.g. iron preparation, Ab.

Investigation

- Stool examination: macroscopic, microscopic, & chemical analysis (pH, sreducing substances), with C./S.
- GUE.
- WBC count & diff..
- Intestinal biopsy.
- Sweat test.
- Serum zinc level.
- Barium meal, follow through, & enema.
- Sigmoidoscopy & colonoscopy.
- Endocrine investigation: T3, T4, TSH, ACTH, cortisol.

Treatment

- Correct dehydration
- Nutritional therapy
- Specific treatment accordingly.

DYSENTERY

Occupy 10 % of cases of diarrhea in children below 5 yr.

Causes

Shigella, Salmonella, Campylobacter, enteroinvasive E. coli, enterohemorrhagic E. coli (especially type O157: H7), & Yersinia.

- Epidemic dysentery occur due to shigellosis until prove otherwise. 60 % of dysentery cases are due to shigellosis. More severe in children with malnutrition.

- It has harmful effect on the nutritional state because of the associated protein loss from the large bowel & anorexia due to the destruction of the endothelium of colon & distal ileum.

- Other cause for bloody D. is E. histolytica (mentioned above).

Clinical manifestations

Frequent diarrhea with RBC & pus cells in the stool, & may be bloody stool & usually associated with tenesmus, abdominal colicky pain, rectal pain, anorexia, convulsion,& fluid loss which may lead to dehydration.

Complication may occur which include intestinal perforation, toxic megacolon, rectal prolapse, septicemia, & hemolytic uremic syndrome.

Diagnosis

- GSE: frank bloody stool, with mucus, RBC, & pus cells.
- Stool C./ S.
- WBC count & differential: leukocytosis with neutophilia in bacterial dysentery & eosinophilia in amebic dysentery.
- Blood C./ S. if septicemia suspected.

Treatment

- Treat dehydration
- Antibiotics for 5 day. Better give oral locally sensitive one, like: ampicillin & co-trimaxazole- trimethoprime, nalidixic acid, & 3rd generation cephalosporin.
- Nutrition supplement.
- Follow up especially for malnutrition or complicated dysentery.

PREVENTION OF GASTROENTERITIS

- Encourage breast feeding.
- Sterilization in bottle feeding.
- Pasturalization of milk.
- Sanitary water supply & sewage disposal.
- Good hygienic food preparation.
- Vaccination against certain important & common pathogen, e.g. Rota virus & oral cholera vaccine.

Specific Causes of Diarrhea

Dietetic diarrhea

It may follow recent change in the type of milk, or recent addition of new foods not suitable for the age of the infant. Detailed dietetic history is important.

Drug induced diarrhea

Most oral antibiotics especially ampicillin can cause diarrhea. Oral vitamins in big amount may also cause diarrhea.

Paranteral diarrhea

It occurs secondary to infection outside the gastrointestinal tract as respiratory &urinary tract infection. The cause is hypermotility.

***It is important to emphasize that in all noninfectious diarrhea ,the diarrhea is usually mild.

Postenteritis malabsorption

It is a common cause of chronic diarrhea following gastroenteritis which causes mucosal injury, & damage of intestinal villi. The main clinical feature is severe watery diarrhea that appears on refeeding with milk. the main causes are:

1.secondary lactase deficiency (post –infectious: diarrhea with abdominal distention & peri-anal erosion. Diagnosis is confirmed by the presence of acidic stool (pH less than 5.4) & reducing substance in stool.

2.milk protein allergy; as cows milk allergy.