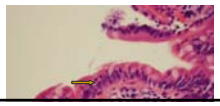
The Intestines

Small and large intestines

- Some disease processes are common to both
- In other ways they are functionally and pathologically different
  - Small bowel – villous surface specialised for food absorption
  - Large bowel – water and electrolyte absorption

Intestinal immune system

- Large amounts of lymphoid tissue throughout intestines
- Specialised MALT. Circulating cells of this system “home” to gut
- B-cells specialised for Ig A production
- T-cells include intraepithelial lymphocytes



Congenital abnormalities

- Atresia or stenosis (e.g. imperforate anus)
- Meckel diverticulum – terminal ileum. Can contain gastric/pancreatic mucosa leading to ulceration/perforation

Hirschprung’s disease

- Developmental disorder characterised by lack of ganglion cells in nerve plexus of gut leading to loss of motility
- Aganglionic segment extends proximally from rectum for a variable distance
- Important cause of childhood constipation

Diarrhoea

- Hard to define
- Some mechanisms
  - Secretory – stimulated by toxins (e.g. cholera)
  - Exudative – more severe mucosal damage with bloody stool (e.g. typhoid)
  - Malabsorption – bulky fatty stools

Infective causes of diarrhoea

- 12,000 deaths *per day* in developing countries (mainly children)
  - Viruses
  - Bacteria
  - Parasites

Viral enteritis

- Rotavirus – cytopathic effect on mature enterocytes, replaced by immature cells with loss of absorptive function (infants mainly)
- Adenovirus

Cause a degree of villous flattening and increased intraepithelial lymphocytes

Bacterial enteritis/enterocolitis

- Mechanisms:
  - Toxin – either formed by proliferating bacteria in gut or ingested directly with food
    - Enterotoxins – disturb metabolic function of epithelium (cholera)
    - Cytotoxins – kill epithelial cells (*Shigella*)
  - Adherence to and invasion of gut tissue (*Shigella, E.coli*)

Salmonella enteritis

- Many *Salmonella* species (e.g. *enteritidis*) exist in animal (poultry) reservoirs and cause diarrhoea through poorly cooked food
- *S. typhi* is confined to humans so spread is purely faecal-oral

Pathogenesis of *Salmonella* diarrhoea

- Organisms invade epithelial cells and macrophages
- Typhoid in particular associated with systemic disease (fever, rash, pain, prostration and GI haemorrhage)
  - Septicaemia preceeds recolonisation of gut and gallbladder
  - Reabsorbed through Peyer's patches which ulcerate (effect of immune reaction)

Pathology of typhoid

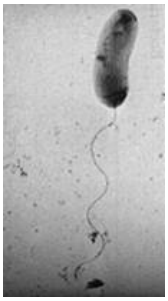
- Longitudinal ulcers
- Perforation
- Haemorrhage
- Cholecystitis
- Multiorgan disease – liver, kidney, bone, striated muscle

Carriers

- Infection can linger in bone and particularly gallbladder
- "Typhoid Mary"

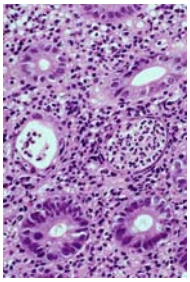
Cholera

- *Vibrio cholerae*
- Noninvasive
- Produces enterotoxin which stimulates enterocyte secretion of salt and water
- Morphological changes not prominent, some villous stunting



Shigella, Campylobacter

- Invasive
- Acute enteritis/colitis with dysentery
- Acute inflammatory cell infiltration of mucosa with crypt abscesses



E.coli

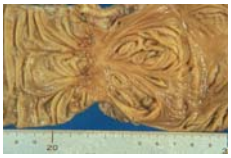
- Very common (travellers diarrhoea)
- Very variable pathogenesis
  - Enterotoxigenic subtypes (E0157 associated with haemolytic uraemic syndrome)
  - Enteroinvasive subtypes (*Shigella* – like)

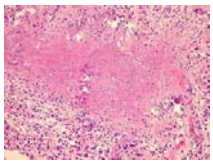
Other bacteria

- *Clostridia – C.difficile* causes antibiotic associated colitis (pseudomembranous)
- *Yersinia* – mesenteric adenitis and ileo-colic ulceration

Intestinal tuberculosis

- Primary – ingestion of organism in unsensitised host. Can cause severe ulcero-inflammatory disease with perforation
- Secondary – swallowing of infected sputum
- Most common in terminal ileum and jejunum
- Complications – obstruction, fistula.

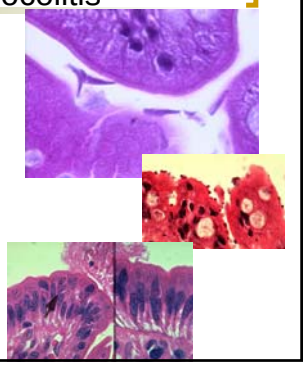




Protozoal enterocolitis

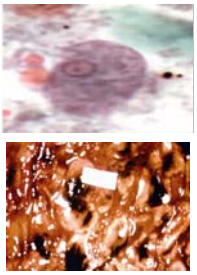
- Giardia – very common worldwide
- Coccidia
  - Cryptosporidiosis
  - Isospora

These organisms associate with cell membrane. Water borne. Very common with HIV



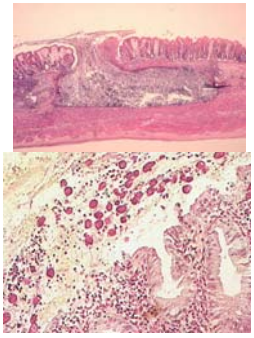
Amoebiasis

- Simple tissue invading unicellular organism
- Deep flask-shaped ulcers



Amoebic dysentery

- Organisms can be seen in inflammatory exudate
- Can spread by blood stream giving an amoebic liver abscess



Nematodes

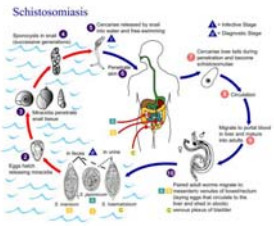
- *Ascaris* – can physically obstruct intestine. Also liver abscess, pneumonia
- Hookworms – mucosal attachment causes erosion and bleeding
- *Strongyloides* – invade wall of gut and can persist for life causing life-threatening systemic disease later (HIV)

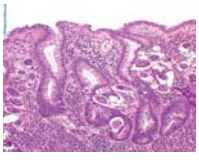
Schistosomiasis

- *S. mansoni* (rarely *S. haematobium*)
- Mainly affects the colorectum
- Larva migrate to liver and mature before moving to submucosal vessels of gut where eggs are laid
- Proctitis, oedema, haemorrhage

Schistosomiasis

- Ova detectable in rectal biopsy
- Chronic inflammation with eosinophils
- Can lead to scarring/obstruction



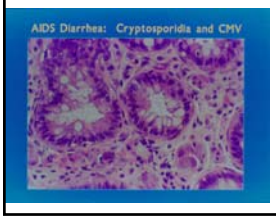


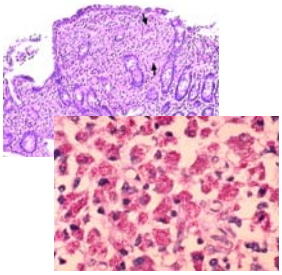
HIV associated disease

- Diarrhoea is a big problem
- Opportunistic infection (candida, cryptosporidia, cytomegalovirus, *Mycobacterium avium-intracellulare,* strongyloides, leishmaniasis)
- HIV itself causes enteropathy
- Kaposi's sarcoma

HIV

- Multiple pathologies common





Malabsorption

- Defective absorption of fats, proteins, carbohydrates and other nutrients (vitamins, minerals)
- Clinical hallmarks are diarrhoea (sometimes very fatty – steatorrhoea), malnutrition

Malabsorption

- Normal process involves
  - Intraluminal digestion
  - Terminal digestion (disaccharidases and peptidases on epithelial brush border)
  - Trans-epithelial transport

Causes of malabsorption (1)

- Defective intraluminal digestion
  - Pancreatic insufficiency (e.g. chronic pancreatitis)
  - Loss of bile flow (biliary obstruction)
  - Nutrient preabsorption by bacterial overgrowth (e.g. in surgical "blind loops")

Causes of malabsorption (2)

- Loss or abnormality of epithelial surface
  - Tropical sprue
  - Chronic infective conditions (e.g. TB)
  - Extensive surgical resection of small bowel
  - (Other chronic inflammatory conditions – Crohn's disease, coeliac disease)

Causes of malabsorption (3)

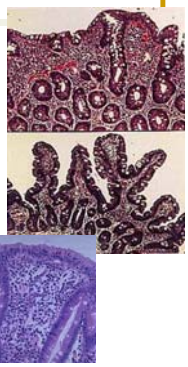
- Lymphatic obstruction
  - TB
  - Lymphoma

Causes of malabsorption (4)

- Infection
  - Acute enteritis of any kind
  - Parasites
  - Tropical sprue

Effects on small bowel

- Atrophy of villi
- Inflammation
- Increased intraepithelial lymphocytes
- Means different things in different populations



Inflamed atrophic small bowel

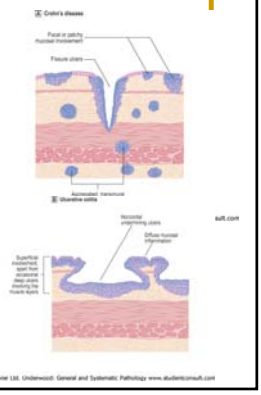
- Europe – coeliac disease
- Africa tropical sprue
  - Bacterial overgrowth following enteritis
  - Can be treated with antibiotics

Idiopathic inflammatory bowel disease

- Crohns disease
  - Involves any part of GI tract
  - Abnormal areas are interspersed with normal “skip lesions”
- Ulcerative colitis
  - Confined to colon
  - Inflammation continuous from rectum

Microscopy

- Crohn’s inflammation is transmural, sometimes granulomatous
- Ulcerative colitis inflammation is mucosal



Inflammatory bowel disease

- A major problem in Europe/N. America
- Apparently uncommon in Africa but may be masked by the predominance of infective disease