



Infants and children frequently present with an acute abdomen but the causes are very different from those in adults.

Aetiology age related

CAUSE	AGE
Appendicitis	10-12 years
Recurrent abdominal pain	
Intussusception	3-18 months
Peritonitis (primary)	5-9 years
Intestinal obstruction	cause related
Ascaris worm infestation	4-10 years
Strangulated inguinal hernia	infants
Gastro-intestinal bleeding	cause related
Foreign body	infants and toddlers
Meckel's diverticulum	50% by 3 yrs of Age

Aim Correct diagnosis and treatment

Diagnosis Careful history
Complete physical examination
Special investigations

N.B. In infants and children, abdominal pain and vomiting, simulating an acute abdominal emergency, may be caused by otitis media, tonsillitis, pneumonia, infectious disease (measles and chicken pox), haemolytic crises in sickle cell disease, spherocytosis, urinary tract infections (UTI) with/without obstructive uropathy and haemolytic uraemic syndrome.

APPENDICITIS

Appendicitis is the most common and important surgical disease of the abdomen in children.

Incidence

Common - great imitator

Peak incidence

10-14 years

Appendicitis is less common in young children but certainly not rare.

Under the age of 5 years, 90% of cases are complicated due to:

- Inadequate communication
- Rapid progression of the inflammatory process
- Under-developed Immune response
- Ineffective localization of the inflammatory process

Pathology

- obstruction: fecolith, lymphoid hyperplasia, worms
- infection: anaerobe: Bacteroides Fragilis
aerobe: E.coli
others: gut flora

Pathogenesis

The appendix lumen becomes obstructed, the appendix then distends due to secretions. This results in increased pressure, which leads to arterial and venous obstruction and eventual ischaemia. Enteric bacteria invade the appendix and cause inflammation and suppuration. The sum total of infection and infarction leads to gangrene and perforation with local abscess formation or diffuse peritonitis.

Pathological classification

- Simple - focal appendicitis, mild hyperaemia and oedema
- Suppurative
- Gangrenous
- Perforated

Diagnosis

Where the diagnosis is suspected but uncertain hospitalize the patient and examine at regular intervals until a decision has been reached.

Clinical

Murphy's triad - pain the first and most important symptom, vomiting and fever

- **Symptoms**

Peri-umbilical abdominal pain is of gradual onset and localizing in the right iliac fossa. Anorexia, nausea and vomiting usually follows the onset of pain.

- **Findings**

An ill child with constitutional upset, e.g. pyrexia, tachycardia, furred tongue, fetor and dehydration. These objective findings may be minimal initially but increase with time.

Tenderness: point tenderness at Mc-Burney's point or generalized tenderness with guarding indicating spreading, peritonitis.

Abdominal distension – due to ileus is usually seen with peritonitis or abscess formation.

Rectal examination is rarely indicated in children.

Right iliac fossa mass

Laboratory findings

Leucocytosis - increased neutrophil count or only shift to the left (11-15 000) - normal count or leukopenia also possible

Urinalysis-in the presence of pyuria or haematuria advisable to do IVP or U/S to rule out primary renal pathology

X-Rays

When the diagnosis is in doubt an abdominal x-ray may show abnormal findings in the RIF e.g. obstruction, ileus or a calcified fecolith (10% of cases), scoliosis concave to the right, a soft tissue mass, and abdominal wall oedema.

Chest x-ray: Rule out pneumonia

Ultrasound: localized evidence of inflammation abscess, fluid, point tenderness.

GANGRENOUS APPENDICITIS

The history is usually longer than 36 hours with fever: >38.6 and leucocytosis $> 15\ 000$

Clinically they present with diffuse tenderness in the right iliac fossa or with spreading peritonitis.

Differential diagnosis:

- Gastro-enteritis - vomiting precedes or coincides with onset of abdominal pain
- Constipation - can cause abdominal pain, fever, vomiting, leukocytosis
- Non-specific abdominal pain in childhood
- Genito-urinary infection – abdominal symptoms with a high fever but less abdominal findings
- Mesenteric adenitis - milder abdominal symptoms and often preceded by upper respiratory tract infection.
- Pelvic inflammatory disease - in girls
- Pneumonia - right lower lobe with referred pain
- Primary peritonitis – high fever, diffuse peritonitis and vaginal discharge
- Intussusception - see later
- Imitators: otitis media, tonsillitis, etc.

It must be remembered however, that these diseases can co-exist and that the decision to operate must be based on the abdominal findings.

Treatment

Appendectomy (even for appendix mass) although certain paediatric centres will treat a well defined abdominal mass conservatively with antibiotics, bed rest and interval appendectomy four to six weeks later.

- The early case - little pre-operative preparation needed
- Late case – treat dehydration, hypovolaemia, sepsis, hyperpyrexia and electrolyte

derangement i.e. intravenous fluid, antibiotics, nasogastric decompression. Only when the child has shown satisfactory response to resuscitation, is he/she fit enough for general anaesthesia and appendectomy. Endoscopic appendectomy is preferred by many surgeons.

Protocol for the Management of Appendicitis

Antibiotic policy: Clinically suspected appendicitis with operation planned - IVI rehydration, FBC, electrolyte, CXR, AXR

Metronidazole suppos. 250 mg if less than 25 kg weight and 500 mg if more than 25 kg weight. Add IVI antibiotics if clinical signs of peritonitis. Penicillin 100,000 kg/24 hrs IVI and Gentamycin 9 mg/kg/24 hrs IVI. Subsequent antibiotic policy depends on findings at operation. Normal appendix – Metronidazole for 1 day. Early acute appendicitis - antibiotics for 24 hrs. Appendicitis with local exudate – IVI antibiotics x 48 hrs. Gangrenous and perforated appendix – IVI antibiotics x 5 days.

Complications

Residual sepsis - wound
- intraperitoneal
Intestinal obstruction - paralytic ileus
- adhesive
Appendiceal stump blowout

Mortality: less than 1% although deaths still occur due to inadequate resuscitation and sepsis.

Special problems

- *Appendicitis in infants* is uncommon and has a high complication rate. They usually present with vomiting, fever, irritability, anorexia, and lethargy. Abdominal examination will reveal a mass in 50% of infants, and there is usually marked abdominal distension.
- *Appendicitis in neonates* is rare and Hirschsprung's disease and

necrotising enterocolitis must be excluded

- *Appendicitis in mentally retarded or paraplegic children.* Appendicitis is common but foreign bodies with impaction, ulceration or perforation of the bowel should be excluded. The severely retarded child have few symptoms and abdominal signs may be difficult to detect.

RECURRENT ABDOMINAL PAIN IN CHILDREN

One of the most common problems seen in the childhood period. A specific diagnosis is seldom found. The problem requires a careful history and complete physical examination to exclude possible organic causes. In most of these children there are no specific signs or symptoms suggestive of a specific organ or system involved. The pattern of attacks is usually variable. Should the children present with abdominal colic it is usually vaguely referred to the umbilicus. Organic significance is seen in colicky abdominal pain when it wakes the child from sleep, causes the child to roll around from pain, lasts for more than 1 hour and where the pain is consistently referred away from the umbilicus, especially to the flanks.

Criteria to assist in establishing the diagnosis of abdominal pain of psychogenic origin

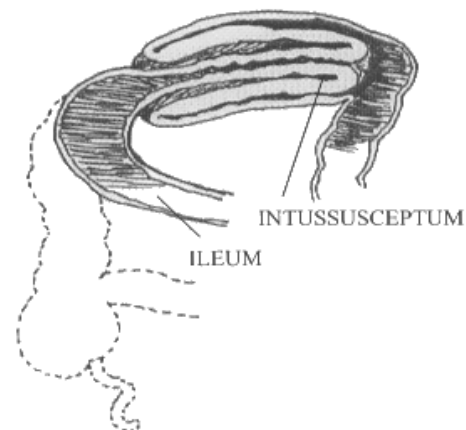
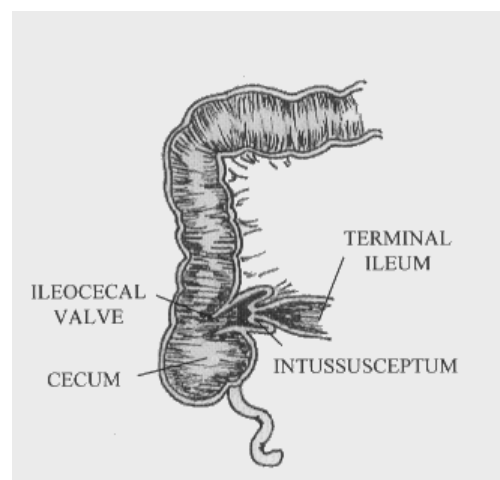
- personality characteristics - anxious, self-conscious, perfectionist
- somatisation of symptoms (internalising behaviour problems)
- prevalence of negative life events
- family factors (integration/coping)- higher family incidence of illness, behaviour and stress factors.
- environmental stress factors (school stress)
- Symptoms - recurrent episodes severe enough to interfere with normal life activities
- Resolution of symptoms between attacks
- Normal laboratory profile: blood count, erythrocyte sedimentation rate, urinalysis and stool for microscopy and culture
- Normal abdominal ultrasound
- Normal lactose breath test
- Normal upper gastro-intestinal study and barium enema
- Normal gastro-intestinal endoscopic findings

- Exclusion of extra-abdominal disease

Most of the children with recurrent abdominal pain of childhood respond favourably to reassurance. They may, however, require psychiatric assessment and help.

Intussusception

This is the invagination of a portion of the intestine into itself. Intussusception is a common cause for intestinal obstruction in infants.



Pathology

Aetiology

Idiopathic - 90%. This is the typical type of intussusception seen and hypertrophy of Peyer's patches following an upper respiratory tract infection or mild enteritis is the most likely cause.

Secondary causes - 10%. There is usually lead point pathology:

Small bowel	- children	21%
	- adults	73%
Colon	- children	4%
	- adults	75%

- *General cause:* Under the age of one year it is usually due to lymphoid hyperplasia. Between the ages of 1-5 yrs hamartomas, and Meckel's diverticulum are common causes. Between the age of 5-12 yrs a tumour either benign or malignant (lymphoma) is the usual cause which is reminiscent of the adults situation where neoplasms are responsible for 50% of cases

Age

Intussusception is usually seen between the age 3-15 months with 85% before the age of 2 years

Anatomical distribution

- Distal ileum and ileo-caecal area 95%
- colon – common in Africa (up to 20%)
- sigmoid-rectal (rectal prolapse?)

Classical picture

A well-nourished male infant presents with, colicky abdominal pain and vomiting. An abdominal sausage shaped and mobile mass is palpable. Red current jelly stools are present in up to 70%. The process invariably leads to intestinal obstruction, bleeding and bowel infarction if not treated timeously. In the initial phase, very little can be found in the abdomen, apart from a tender sausage shaped mass along the course of the colon, or slightly towards the umbilical area.

In the well advanced case the child is apathetic, prostrated and from time to time becomes restless with drawing up of the legs.

A rectal examination reveals bloody mucoid stools. Later in the evolution, abdominal distension becomes more apparent and the head of the

intussusception may be felt rectally or even prolapse through the anus, which then must be regarded as a grave sign.

Radiology

X-ray

Soft tissue mass

Intestinal obstruction

Barium enema

Coil spring (head of intussusception)

Ultrasound

“target” or “swiss roll” sign

Treatment

There is always a degree of intestinal obstruction and fluid deficit. The treatment therefore should be to resuscitate the child with correction of fluid and electrolyte derangement. A naso-gastric tube is passed, intravenous fluid 10 – 20 ml/kg is given, and the infant is taken to the x-ray department for diagnostic barium enema once adequately resuscitated. After adequate resuscitation and sedation a hydrostatic barium enema or pneumatic reduction with air at a maximum pressure of 120 mm/Hg is attempted. Pneumatic reduction should not be attempted in the presence of:

- Established intestinal obstruction
- A tender mass
- Peritonitis
- Advancing sepsis and shock.
- Massive rectal bleeding.

In these cases, laparotomy and surgical reduction or in the presence of non-viable bowel, resection and anastomosis should be performed.

In older children with a successful non-operative reduction, a double contrast barium enema should be done 14 days later to rule out significant local pathology. If doubtful or with recurrence of the intussusception, it is advisable to proceed with a laparotomy (could be lymphoma of terminal small bowel, etc.)

Prognosis:

The recurrence rate is \pm 5% following non-operative reduction and 2% after surgical reduction.

Postoperative intussusception

common in children, occurs after major or minor intra abdominal or retroperitoneal surgery, presents with colic and vomiting 3-7 days after the initial intervention. Usually occurs in the mid small bowel and may be multiple. Rarely complicated by necrosis. Operative reduction is required.

PERITONITIS

"The peritoneum is well prepared for combat"

- Ian Aird

Primary: infection of the peritoneal cavity that does not result from infection in an abdominal organ.

Secondary

- Peritonitis can be caused by bacteria from the alimentary tract due to a perforated viscus, acute inflammation or bowel gangrene e.g. appendicitis, perforated D.U
- Post-surgery
- Injuries (stab wounds)
- General septicaemia.

PRIMARY PERITONITIS is not infrequent in children and a cause is often not found. The children usually present between 5-9 years of age and is predominantly seen in girls except under circumstances of cirrhosis and the nephrotic syndrome

Organism

Predominantly Pneumococcus, Streptococcus or Gonococcus. Gram negative organisms are occasionally seen. It is usually a monomicrobial infection.

Aetiology

The organisms reach the peritoneal cavity via lymphatic or hematogenous spread and in female patients along

the genital tract or it may be a local manifestation of septicaemia. It is important to rule out immunodeficiency syndromes and the nephrotic syndrome.

Clinically

It is a rapidly progressive disease and difficult to recognise in infants and children. They may present with constant abdominal pain with vomiting, diarrhoea, tachycardia, pyrexia and dehydration, e.g. non-specific symptoms. There are usually no focal signs. Abdominal distension, guarding and tenderness but little or no true rigidity is found.

Treatment

It is difficult to differentiate between primary and secondary peritonitis and if abdominal aspiration yields a monoflora culture the diagnosis is primary peritonitis until proven otherwise and appropriate antibiotics should be given. When in doubt early laparotomy or laparoscopy should be contemplated.

INTESTINAL OBSTRUCTION

This condition is in essence similar to that experienced in later life except for aetiology. Children may deteriorate rapidly with delay in diagnosis.

Causes

- Sepsis
- Intussusception
- Ascaris worm infestation
- Incarcerated inguinal hernia
- Post-operative adhesive obstruction
- Congenital abnormalities

Notes on: *Adhesive small bowel obstruction in infants and children:*

- Common cause for intestinal obstruction
- Occurs most commonly after laparotomy for inflammatory or neoplastic disease
- Re-occurs in 5% within 2 years of previous small bowel obstruction
- High morbidity if bowel is opened

- during adhesiolysis
- May benefit from pre-operative antibiotics.
- Laparotomy required in most cases

Symptoms

Recurrent abdominal pain, with persistent bile stained vomiting, abdominal distension and visible or palpable loops of bowel.

Tenderness usually signifies compromised bowel

The diagnosis can be confirmed on abdominal X-ray:

Management

- Nil per mouth
- Nasogastric tube decompression
- Intravenous fluid and electrolytes
- Correction of metabolic and haematological abnormalities
- Prophylactic antibiotics.
- Indications for operation: failure to respond in 12 hours

INTESTINAL HELMINTHS (ASCARIASIS)

Common cause for admission to hospital. In developing countries, Ascaris is the most prevalent and largest of human helminths. Twenty percent of world population are infested. At Red Cross Children's Hospital, 45% of children seen in the out-patient's department harbour this parasite. The normal habitat of the worm is in the upper small bowel. The ova are passed in the stool and ano-oral route of contamination continues the life cycle.

Age: 1-8 years i.e. when children explore environment and infest themselves.

Abdominal complication

worm colic, intestinal obstruction, peritonitis, acute appendicitis, acute pancreatitis, hepatobiliary ascariasis

Clinical features

The spectrum depends on worm load and the location of the worms. Majority (97%) present as 'worm colic'

and requires only nasogastric decompression, intravenous fluid, anti-spasmodics, sedation, and careful observation. With deterioration in the clinical signs, evidence of bowel obstruction on abdominal x-ray, surgery is advised. Fortunately, the majority will respond to conservative treatment and a vermifuge is given only on disappearance of the acute abdominal symptoms and signs.

Hepatobiliary infestation also presents with colic and local RUQ tenderness. Diagnosis is confirmed by ultrasound. Persistence of biliary or intrahepatic worms require operative intervention.

GASTRO-INTESTINAL BLEEDING

Gastro-intestinal bleeding occurs frequently.

Definitions

Hematemesis: vomiting of recognisable blood

Coffee ground bloody emesis clinically altered blood

Melaena: tarry black stools (high small bowel or stomach)

Hematochezia: red blood per rectum from colon or rectum

Management

In general terms one should confirm the bleeding and exclude a bleeding diathesis. The volume and rate of bleeding should be determined and the cause identified. A bleed of 20ml/kg is characterised by hypovolaemia (normal volume 80ml/kg). To determine the site of bleeding the following principals can be used i.e. with a bloody stomach lavage, the bleeding is usually from a site above the ligament of Treitz. If there is no blood in the stomach it can be assumed that the bleeding point is in the distal gastro-intestinal tract. Stool microscopy and culture should be done routinely. Special investigations to determine the cause may include endoscopy, barium meal, barium enema, and screening for bleeding diathesis which must be corrected if abnormal.

With hypovolaemia 20 ml/kg of blood should be transfused and repeated until hypovolaemia is corrected.

Neonatal gastro-intestinal bleeding can be caused by swallowed maternal blood or due to the haemorrhagic disease of the newborn (Vit.K.deficiency) with a bleeding diathesis, peptic ulcer, necrotising enterocolitis or midgut volvulus.

Gastro-intestinal bleeding in children and adolescents: Common causes are oesophageal varices, peptic ulceration, Meckel's diverticulum, intestinal polyps, intussusception, haemangiomas and a fissure-in-ano.

FOREIGN BODIES: (FB)

Foreign bodies are commonly swallowed by infants, toddlers and mentally retarded children. Lodgement is usually in the trachea, bronchial tree or gastro-intestinal tract. **NB:** Position of FB must be confirmed with an AP and lateral x-ray.

Management: General rules

Foreign bodies in the oesophagus: endoscopic removal.

Foreign bodies in stomach and distally: Once in the stomach, foreign bodies will pass within 24-48 hours in 95% of cases. There is no need to hospitalize the child but he/she should return in 5 days if the foreign body has not been seen in the stool.

Indications for surgical removal are: continuous abdominal pain, vomiting or blood in the stool or in an asymptomatic child where the object has not passed within a 4-5 week period.

Foreign bodies with sharp edges. These will also pass spontaneously without problems in the majority of cases. If they remain at the same site for a few days, or with abdominal symptoms, laparotomy is indicated.

Alkaline batteries: If the battery has lodged in the oesophagus, endoscopic removal is done immediately. If the battery is in the stomach, a prokinetic agent is given and stomach pH is neutralised with antacid. The battery usually passes. If the battery is in the intestine accelerated passage is encouraged with Mg SO₄ or an enema once the battery is in the colon. If the battery is retained in the stomach for longer than 12-24 hours magnetic or endoscopic removal is indicated. Prompt removal of the battery is indicated if there is no progression along the gastro-intestinal tract (serial abdominal x-rays), if the casing is broken, or the child develops abdominal symptoms.

MECKEL'S DIVERTICULUM: (INCOMPLETE ATRESIA OF VITELLINE DUCT)

This is persistence of the embryonic communication between the yolk sac and the apex of the midgut, which normally disappears at about 5 weeks of foetal life. The incidence is 2%. In most cases a Meckel's diverticulum is asymptomatic although complications are not infrequently seen especially in children <2 years.

Abnormalities:

- Fibrous band
- Persistent umbilical mucosa
- Meckel's diverticulum
- Enterotoma
- Entero-umbilical fistula

Site: 12-100 cm proximal to the ileocaecal valve - at the apex of the midgut.

Size: 1-5 cm in length. Heterotopic gastric mucosa is present in 50-80% of symptomatic Meckel's.

Complications:

Diverticulitis secondary to obstruction. Peptic ulceration, secondary to heterotopic gastric mucosa. Volvulus around its attachment to the umbilicus.

Intussusception. Bleeding from a Meckel's diverticulum is usually large and painless.

Presenting features:

- Umbilical vitelline duct remnants.
- Acute abdomen
- Rectal bleeding.
- Non-specific abdominal pain.
- Bowel obstruction.

Diagnosis: Tc 99m scan for bleeding Technetium selectively taken up by gastric mucosa.

Management:

Symptomatic Meckel's diverticulum: resection

Asymptomatic Meckel's diverticulum is best left alone. Resection is indicated:

- if it contains abnormal tissue
- a narrow neck
- very long
- with evidence of prior diverticulitis
- with persistence of a remnant of the vitelline duct.



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