

Appendicitis in Children

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"Providing the very best care to each patient on every occasion"



Aims

- Epidemiology & Aetiology
- Differential Diagnosis
- Clinical Presentation
- Diagnosis
 - Clinical
 - Laboratory
 - Scoring systems
- Imaging
- Conclusions



Objectives

- By the end of this session you will be able to:
 - List the major clinical signs of appendicitis
 - Discuss the role of investigations in the diagnosis of appendicitis
 - Appropriately refer paediatric patients with suspected appendicitis



Epidemiology and Aetiology



Epidemiology

- 10% of people in the UK will develop appendicitis
- More common between 10 and 20 years of age
 - But can occur at **any** age
- Mean age in children is 6 to 10 years
- Males affected more than females
- Children with appendicitis younger than 2 years of age often present with perforation
 - Diagnosis difficult in this age group



Aetiology

- Obstruction of the appendiceal lumen is the primary cause
 - Faecolith or lymphoid tissue
- Intraluminal fluid accumulates
 - Leads to appendiceal distension
- Poor venous drainage and lymphatic drainage allows bacterial proliferation in the wall
- Ischaemia and necrosis can develop
- Advanced cases may perforate
 - Generalised peritonitis



Differential Diagnosis



Differential Diagnosis

- Appendicitis
- Acute gastroenteritis
- Constipation
- Intussusception
 - HSP
- Lobar pneumonia
- Meckel's diverticulum
- Mesenteric adenitis
- Mitterlschmerz pain
- Torsion of ovarian cyst
- Right-sided pyelonephritis
- Pelvic inflammatory disease
- Ectopic pregnancy
- Renal calculi
- Urinary tract infection



Gastroenteritis



Gastroenteritis

- Common cause of abdominal pain in children
- Vomiting, diarrhoea, fever
- Rotavirus, adenovirus, enterovirus, Norwalk
- Examination may reveal generalised tenderness
 - Increased bowel sounds
 - Signs of dehydration



Constipation



Constipation

- Can be recurrent
- Can cause severe abdominal pain
- Most often left sided or supra-pubic
- Firm stool *may* be palpable in the lower abdomen



Intussusception



Intussusception

- Remember HSP
- Intermittent colicky abdominal pain
- Vomiting
- Passage of blood +/- mucus per rectum
- Median age 18 months
- Usually pallor and lethargy
- Can sometimes feel sausage shaped mass in lower abdomen



Right Lower Lobe Pneumonia



Lobar pneumonia

- Right lower lobe pneumonia
 - Can cause lower right abdominal pain
- Fever may be present
- Abdominal tenderness minimal
- May have respiratory signs
 - **Caution** – not always immediately obvious



Meckel's Diverticulum



Meckel's Diverticulum

- Difficult to clinically distinguish from Appendicitis
- Pain is similar in nature
- Needs expert opinion



Mesenteric Lymphadenitis



Mesenteric Lymphadenitis

- Associated with adenovirus infection
- History of painful throat may be present
- May have other lymphadenopathy
- Generalised abdominal pain
- Signs of peritonitis generally absent



Mittelschmerz Pain



Mittelschmerz Pain

- Lower abdominal pain
- Typically mid-cycle of menstruation
- Females only
- Follicular cyst ruptures and is associated with bleeding
- Symptoms usually resolve in a few hours
- Patient usually well



Torsion of Ovarian Cyst



Torted Ovarian Cyst

- Females only
- Difficult to rule out
- May need to image abdomen and pelvis
- May not have all of the other symptoms and signs of appendicitis



Right-sided pyelonephritis



Right-sided Pyelonephritis

- Can have fever and rigors
- May be right sided loin or flank pain
- Can have increased frequency of micturition
- Dysuria
- Maximal tenderness over the loin



Pelvic Inflammatory Disease



Pelvic Inflammatory Disease

- Generalised abdominal tenderness
- Usually caused by *Chlamydia trachomatis* or *Neisseria gonorrhoea*



Ectopic Pregnancy



Ectopic Pregnancy

- Differential diagnosis to be ruled out with a negative pregnancy test
- There will only be vaginal bleeding if there is some degree of rupture
- Haemoperitoneum will only be present if rupture has occurred



Renal Calculi



Renal Calculi

- Radiation of the pain is different from appendicitis
 - Loin to groin pain
- Urinalysis usually shows blood
- May see stone on X-Ray
 - Caution as some stones are not radio-opaque



Clinical Presentation



Clinical Presentation

- More difficult in young children
- In older children can present like adults
- Infants have different presentation
- Perforation occurs in 23-73% of patients



Older Children

- Tend to present like adults
 - Low grade fever
 - Abdominal pain
 - Right iliac fossa tenderness



Younger Children

- May have different presentation from older children which can include
 - Vomiting
 - Fever
 - Irritability
 - Grunting
 - Abdominal pain or distension
 - Diarrhoea
 - Limping or right hip pain



Infants

- Diffuse peritonitis can develop quickly
- Greater omentum is under-developed and does not contain or localise infection



Diagnosis



Clinical Diagnosis

- Sensitivity of clinical examination ranges from 54% - 70% in children and 70 – 87% in adults
- Fever is the most useful sign in children who present with abdominal pain (Likelihood ratio (LR) +3.4)
- Absence of fever decreases likelihood (LR -0.32)
- Periumbilical pain radiating to RIF increases risk (LR +1.2)



Clinical Diagnosis

- Presence of rebound tenderness triples likelihood (LR 3.0)
- Absence of rebound tenderness reduces likelihood (LR -0.28)
- Do **NOT** perform rectal examinations in people under 16 years of age with abdominal pain
 - Does not add further to the diagnostic information



Laboratory



Laboratory

- Normal WBC and CRP do not rule out appendicitis
- If diagnosis suspected clinically **normal** investigation results do not help (except HCG – pregnancy test)
 - Raised WBC and CRP help give more weight to diagnosis once suspected
- Bottom line:
 - If suspect clinically, don't need further investigations to confirm



Clinical Scoring Systems



10 point Alvarado Score

- Migration of pain 1
- Anorexia 1
- Nausea / vomiting 1
- RIF tenderness 2
- Rebound tenderness 1
- Temperature $>37.5^{\circ}\text{C}$ 1
- Leucocytosis 2
- Left sided WBC shift 1



Alvarado Score

- Recommends surgery for scores ≥ 7 and observation for scores 5 & 6
 - Prospective evaluation in children has shown sensitivity 76-90% and specificity 72-79%
- Score does not have a sufficiently high positive predictive value (65%) to decide on surgery



Paediatric Appendicitis Score

- Fever $>38^{\circ}\text{C}$ 1
- Anorexia 1
- Nausea or Vomiting 1
- Cough/percussion/hop tenderness 2
- Right lower quadrant tenderness 2
- Migration of pain 1
- Leucocytosis 1
- Neutrophilia 1

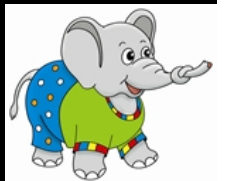


Paediatric Appendicitis Score

- Patients with score of ≤ 2 could be discharged home (sensitivity 96%, specificity 74%)
- Patients with score of ≥ 6 could be taken to theatre
- Patients scoring 3-5 may need further investigations
- Scoring method **alone** not sensitive or specific enough to make decision for surgery



Imaging in Appendicitis



CT Scanning

- Rarely used in the UK due to use of contrast material and the radiation risk
- Not as accurate in children as in adults
- CT appearances of appendicitis:
 - Appendix greater than 6mm in diameter
 - Presence of appendicolith
 - Peri-appendiceal inflammation or abscess



Ultrasound scanning

- Graded compression technique
- Findings suggestive of appendicitis:
 - Fluid filled distended structure greater than 6mm diameter
 - No peristaltic activity
 - Non-compressible
 - Constant in shape and position
 - Anterior to psoas muscle or in retrocaecal position



Ultrasound scanning

- Sensitivity 71 – 92%
- Specificity 96 – 98%
- Therefore, can rule in but can't rule out appendicitis
- Operator dependent



Abdominal X-Rays

- Have no role to play in the diagnosis of appendicitis in children and should not be performed for this purpose



Complications



Complications of Appendicitis

- Generally secondary to a delay in diagnosis
- Include
 - Perforation
 - Sepsis
 - Shock



Conclusions



Conclusions

- Acute appendicitis
 - is the most important cause of acute abdominal pain in children
 - Is the commonest cause of acute abdominal pain requiring emergency surgery
- Prompt diagnosis, immediate referral and expeditious surgery should be undertaken to reduce the risk of perforation
- Clinical presentation may be atypical or may be similar to other conditions



Conclusions

- Appendicitis is a challenging condition especially in children under 2 years of age
- Laboratory tests cannot be used to rule out a diagnosis
- Scoring systems do not have a sufficiently high positive predictive value to decide if surgery is required



Bottom line...

- If a patient presents with suspected appendicitis they should be assessed by a paediatric surgeon to determine further management....



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Conclusion

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References

- Acheson J & Banerjee J. Management of suspected appendicitis in children. *Archives of Disease in Childhood Education & Practice Edition* 2010; 95: 9-13

