



## Vermiform Appendix And Acute Appendicitis

Sanjay Kumar Bhasin, Arsad Bashir Khan, Vijay Kumar, Sanjay Sharma, Rakesh Saraf

### Introduction

The Vermiform appendix present only in human beings, certain arthropod apes and the wombat (a nocturnal, burrowing Australian marsupial) was probably first noted as early as the Egyptian civilization (3000 B.C). During the mummification process, abdominal parts were removed and placed in coptic jars with inscriptions describing the contents as “worm of the intestines” were discovered (1). The Vermiform appendix is considered by most to be a vestigial organ, its importance in surgery due mainly to its propensity for inflammation that results in the clinical syndrome known as Acute appendicitis. Acute appendicitis is the most common cause of “acute abdomen” in young adolescents and appendectomy is often the first major procedure performed by a Surgeon in training (2,3,4). Variations in the position of the appendix, age of the patient and degree of inflammation make the clinical presentation of appendicitis notoriously inconsistent. Misdiagnosis in different age groups is from 10 to 33% (5). Despite extraordinary advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of appendicitis remain essentially clinical requiring a mixture of observations, clinical acumen and surgical sense.

**Anatomy:** Embryologically, the appendix is continuation of the caecum and is first delineated during the fifth month of gestation. The appendix does not elongate as rapidly as the rest of the colon, thus forming a worm like structure (2,3,6). The origin of appendix is about 2.5 cms below the ileocaecal valve from the posteromedial aspect of Caecum. It is the only organ in the body that has no constant anatomic position and only constant feature is its mode of origin from the caecum where it arises from the site where three teniae coli coalesce. It varies considerably in length from 1 to 25

cms; but mostly it ranges between 5-10 cms. The appendix may be positioned as preileal, postileal, paracolic, retrocaecal, subcaecal, pelvic and rarely subhepatic (2). The incidence as per position of appendix has been reported as 65.28% for retrocaecal, 31.01% pelvic, 2.26% subcaecal, 1% preileal and 0.4% for right paracolic/postileal (7). At routine CT Scan it was observed that retroileal appendix appears to occur much more frequently in living subjects (8,9). Absent appendix is too rare a condition and till date only 68 cases have been reported in the literature (10). Similarly duplication of appendix is also a rare anomaly and fewer than 100 cases have been reported (11-13).

Appendicular artery represents entire arterial supply of the organ an end artery arising from Ileocolic artery. Thrombosis of this artery in acute appendicitis inevitably results in gangrene and subsequently perforation. Veins from Appendix drains into the ileocolic vein which empties into superior mesenteric vein. A variable number of slender lymphatic channels traverse the mesoappendix to empty into the ileocaecal nodes.

**Etiopathogenesis:** Obstruction of the lumen is the dominating factor in acute appendicitis. Fecoliths are usual cause of appendiceal obstruction. Less common is hypertrophied tissue, inspissated barium from previous X-rays, vegetable, fruit seed, worms (*Enterobius vermicularis*, *Balantidium coli*, *Schistosoma haematobium*) (14-15). Due to this blockade closed loop obstruction results and the secretions continuously produce distension that stimulates nerve endings of visceral afferent pain fibers producing vague, dull, diffuse pain in the mid abdomen or lower epigastrium. Distension also stimulates peristalsis that results into crampy abdominal pain superimposing visceral pain. Distension continues and

From the Postgraduate Department of Surgery, Govt. Medical College Jammu. J&K. India, Pin: 180 001.

Correspondence to : Dr. Sanjay Kumar Bhasin. 37-New Company Bagh Canal Road, Jammu. J&K. (180 001).



pressure in organ increases and exceeds venous pressure, thereby, occluding capillaries and venules but arterial inflow continues, resulting in engorgement and vascular congestion. Distension of this magnitude usually causes reflex nausea and vomiting and diffuse visceral pain become more severe. The inflammatory process involves the serosa of appendix, thereby, involving parietal peritoneum that produces tenderness as well as rebound tenderness. Progressive distension increases arterial pressure and the area with poorest blood supply suffers most; ellipsoidal infarcts develop in the antimesentric border. As the distension, bacterial invasion, compromise of vascular supply and infarction progress, perforation occurs through one of the infarcted areas on antimesentric border.

**Pathology:** The menace of acute appendicitis lies in the frequency with which the peritoneal cavity is infected from this focus, either by perforation or by transmigration of bacteria through the appendicular wall. The greater omentum attempts to wall off the spread of peritoneal invasion while violent peristalsis from ingested purgatives tends to spread it.

**Non-obstructive acute appendicitis:** The inflammation commences either in mucous membrane or in lymph follicles and terminates either as resolution, ulceration, suppuration, fibrosis or gangrene. Infection progresses rapidly once it reaches submucous tissue. The organ becomes turgid, dusky red and haemorrhage occurs into the mucous membrane. The vascularity of the distal part of appendix is often in jeopardy as the artery is intramural and liable to occlusion by inflammation/thrombosis thereby, leading to gangrene of the tip. The non-obstructive appendicitis progress slowly allowing protective barrier to develop and at times inflammation do not progress beyond the mucosal lining (Catarrhal appendicitis) and attack goes off without sequele.

**Obstructive acute appendicitis:** 2/3rd cases belong to this group. The obstruction is either in the lumen (Faecolith, foreign body, Parasite) or in the wall (invariably inflammatory but may be direct occlusion by carcinoma of caecum) or outside the wall (adhesions/kinking). Products of inflammation proceed more rapidly and more certainly to gangrene/perforation. Within 12-18 hrs appendix distal to the obstruction becomes gangrenous. Perforation occurs most commonly at the site of impacted

faecolith before protective adhesions have had time to form. The escaping purulent and gaseous contents are under high pressure and early widespread peritonitis is liable to ensue.

**Factors encouraging Progression of Inflammation:**

- (i) Very young/old. (ii) Immunosuppressive agents.
- (iii) Free lying appendix. (iv) Presence of faecolith.
- (v) Purgatives/enema. (vi) Impaired blood supply.

**Clinical Features:** The clinical features are more pronounced and progressive in obstructive than non-obstructive acute appendicitis. Pain that starts from periumblical area/epigastrium shifts to right iliac fossa in due course of time. Coughing causes localized pain in RIF in acute appendicitis and is absent in renal disease. Once parietal peritoneum is involved it produces more intense, constant and localized somatic pain that shifts and has changed its character. This classical visceral-somatic sequence is seen in only 50% of patients of acute appendicitis as early signs and symptoms depend upon the location of the tip of the appendix that is highly variable (2-4). In early appendicitis, the patient is initially afebrile or has a low-grade fever. Appendicitis in elderly is difficult problem resulting in incorrect diagnosis as well as high rate of perforation (16). High fever is associated with a perforated appendicitis (17). The clinical symptom/signs are detailed in table I.

**Table I: Symptoms and Signs in Acute appendicitis.**

S.No	Symptoms	Signs	Special Signs/Tests
1.	Pain*	Increased temperature#	Rovsing's sign
2.	Anorexia	RIF tenderness	Pointing sign
3.	Nausea	RIF Guarding	Release sign (Rebound)
4.	Fever	Tachycardia	Copes-psoas test
5.	Constipation**	Brown-furred tongue	Obturator test
6.	Diarrhoea**	Foul breath	
7.		Hyperaesthesia (Sherrren's triangle)	

Note:

\* Pelvic position produces no somatic pain but suprapubic discomfort and tenesmus.

\*\* Constipation is invariably present but in pelvic type diarrhea may predominate.

# In children temperature > 38.5o C suggest some other pathology.

**Differential Diagnosis:** Although acute appendicitis is the most common acute abdomen requiring surgical intervention yet in the absence of definite supportive diagnostic investigation it requires to be differentially diagnosed from a variety of clinical conditions. Even the most experienced physicians and surgeons are not able to diagnose appendicitis 100% of the times. Table II & III.



Table II: D/D of Acute appendicitis as per anatomical variations.

S. No	Attic/	Upper storey	Ground floor	Basement	Backyard/Retr operitoneum	Others
1	Tonsillitis	Perforated Ulcer	Enteritis	Salphingitis	Uretric colic	Preherpetic neuralgia
2	Pneumonia	Acute cholecystitis	Non-specific mesenteric lymphadenitis	Ectopic gestation rupture	Acute Pyelonephritis	Tabetic crises
3	Pleurisy	Cyclical vomiting	Int. obstruction	Rt. Ovarian torsion		Spinal TB
4			Meckle's diverticulitis	Ruptured ovarian follicle (Mittelschmerz)		Blood diathesis
5			Terminal ileitis			Porphyria
6			Ca caecum			Henoeh-Shoenlein syndrom
7			Sigmoid diverticulitis			Ac. Pancreatitis
8						Rectus sheath hemtoma

Table III:D/D as per age.

Table III:D/D as per age.

S. No.	Children	Adults	Adult females	Elderly
1.	Gastroenteritis	Ureteric colic	Mittelschmerz	Diverticulitis
2.	Mesentric adenitis	Perforated peptic ulcer	Salphingitis	Int. obstruction
3.	Meckel's Diverticulitis	Pancreatitis	Pyelonephritis	Ca Colon
4.	Intussusception	Rectus sheath haematoma	Torsion/ruptured Ovarian cyst	Torsion appendix epiploicae
5.	Henoeh-Schonlein purpura	Torsion testis	Ruptured ectopic gestation	Mesenteric infarction
6.	Lobar Pneumonia	Regional enteritis	Endometriosis	Aortic aneurysm

**Investigations:** Although the diagnosis of acute appendicitis invariably is clinical yet it may be supported by exclusion after doing some investigations. No test yet devised that is 100% diagnostic. The only diagnostic procedure short of open exploration is diagnostic laparoscopy.

1. WBC: In 3/4th cases of acute appendicitis TLC is more than 12,000 (18). Tc- labeled WBC Scan has reported sensitivity of 98% and specificity of 95%. However, time constraint and availability is an issue (19-20).

2. Urine examination: Though normal in many instances yet it may be showing pyuria/microscopic haematuria. If the surgeon is satisfied that appendicitis cannot be ruled out, operation under such circumstances is entirely justified; that may show inflamed appendix adhere to right ureter/bladder.

3. Radiography: Finding as proposed by various authors on plain X-Ray abdomen as well as barium meal follow through are listed in table IV (3, 21, 22). It is pertinent to mention here that emergency barium enema is practiced in USA only and not in any other country.

Table IV: Plain X-ray Abdomen and Barium Enema Findings in Acute appendicitis.

S. No	Plain X-ray Findings	Barium Enema Findings
1.	Fluid levels localized to caecum/terminal Ileum	Persistent non visualisation of appendix
2.	Localised ileus with gas in caecum/ascending colon	Partially visualised appendix
3.	Increased soft tissue density in right lower quadrant	Pressure defect on the caecum
4.	Blurring of right flank stripe	Irritable caecum/ terminal ileum on screening
5.	Faecolith in right iliac fossa	
6.	Blurring of Rt. Psoas shadow	
7.	Free intraperitoneal gas	
8.	Deformity of the caecal gas shadow	

4. Ultrasonography of abdomen: More useful for differential diagnosis. With experience one may find acutely inflamed appendix as non-compressible, aperistaltic, tubular structure with a central dilated lumen surrounded by an inner echogenic mucosal layer and outer oedematous wall that shows few echoes (23-25).

**Treatment:** The treatment of acute appendicitis is appendectomy. In the absence of appendicular mass, appendix should be removed at the earliest as the operative mortality is almost negligible but it may increase several fold if operation is delayed. The appendectomy may be either open or laparoscopic. Unlike Laparoscopic cholecystectomy, laparoscopic appendectomy has failed to establish itself as minimally invasive procedure of choice both in children and adults (26-28).

**Open Appendectomy**

**Conventional-appendectomy:** Done by standard methods with the help of either of the available incisions (Grid Iron, Rutherford-Morrison's, Rocky Davis, Lanz, Paramedian, Midline)

**Mini-appendectomy:** This is done with the help of small transverse incision 2 to 2.5 cms starting from lateral border of rectus abdominis muscle and extended towards Mc Burney's point. Anterior sheath is cut in line of skin incision, rectus muscle retracted medial and blended posterior sheath/peritoneum cut in line of skin incision. Once peritoneum is approached, with little manipulation appendix is delivered towards wound site and appendectomy completed as per standard protocol. Appendiceal stump is not buried and we do not close posterior peritoneum, retracted rectus muscle comes to its place once anterior sheath is closed. Skin is approximated with silk/clips/subcuticular prolene (29,30).

**Laparoscopic-Appendectomy:** Though done by many at many centers yet to find large scale favour from



surgical fraternity as procedure of choice for appendicitis.

**Summary:** Vermiform appendix probably noticed in the the egyption civilisation 3000BC has undergone so many revelations since then. It includes McBurney's clinical findings in acute appendicitis as well as grid iron incision to laparoscopic appendectomy and mini appendectomy. The classic presentation of a patient with appendicitis includes a history of initial periumbilical or epigastric gradual onset and progressively worsening pain migrating to the right lower quadrant, more specifically RIF. Diagnosis of classical acute appendicitis is established by good clinical acumen, but in atypical cases of appendicitis controversy continues over the most accurate, cost effective and rapid method of making the diagnosis. Surgical consultation remains the most effective method of deciding what additional diagnostic tools are needed. The early surgical removal of inflamed appendix remains the best method of treatment for total cure in addition to minimizing morbidity and mortality. The surgical methods available are open and laparoscopic appendectomy. In the absence of non-establishment of laparoscopic appendectomy as minimally invasive procedure of choice, the mini-appendectomy may be tried and steps taken to establish it as minimally invasive procedure of choice for appendectomy.

#### References

- Herrinton JL Jr. The Vermiform appendix: its surgical history. *Contemp Surg* 1991; 39: 36-44.
- P. Ronan O' Connell. The Vermiform Appendix. Russell RC, Williams NS, Bulstrode CJ, (eds). In Bailey and Love's Short Practice of Surgery, 23rd Ed. London, UK: *Arnold Publishers* 2000; pp 1076-92.
- Rosemary A Kozar, Joel J Roslyn. The Appendix. In: Principles of Surgery. 7th International edition, Seymour I Schwartz, (ed); *McGraw-Hill Health Profession Division* 1999: pp 1383-94.
- Condon RE. Appendicitis. In: Sabiston DC, ed. Textbook of surgery. 13th ed. *Philadelphia: W B Saunders*, 1986:967-82.
- Ohmann C, Young Q, Frank C: Diagnostic scores for acute appendicitis. Abdominal pain Group. *Eu J Surg*, 2002;16: 273-81.
- Codon RE, Telford GL: Appendicitis: In: Townsend CM, (eds). Sabiston Text book of Surgery: The Biological Basis of Modern Surgical Practice. 14th ed. *Philadelphia, Pa: WB Saunders and Co*; 1991: pp 884-98.
- Wakely CP. The position of the Vermiform appendix as ascertained by analysis of 10,000 cases. *J Anat* 1933; 67:277.
- Pickens G, Ellis H. The normal Vermiform appendix at Computed tomography; visualization and anatomical location. *Clin Anat* 1993;6:9.
- Oto A, Ernst RO; Miles Ki NJ *et al*. Localisation of Appendix with MDCT and influence of findings on choice of Appendectomy. *AJR* 2006; 187: 987-90.
- Robinson JO. Congenital absence of Vermiform appendix. *Br J Surg* 1952; 39:344.
- Khanna AK. Appendix Vermiformis duplex. *Postgrad Med J* 1983; 59:69.
- Wallbridge PH. Double appendix. *Br J Surg* 1962; 50:346.
- Tickler LF. Triple appendix vermiformis-a unique case. *Br J Surg* 1968; 55:79.
- Duzgun AP, Moran M, Uzun S *et al*. Unusual Findings in appendectomy specimens: Evaluation of 2458 cases and review of the literature. *Ind J Surg* 2004; 66: 221-26.
- Fernder Blanco CM, Fraguera JA, Gulias A *et al*. Villious adenoma of the appendix: diagnostic and therapeutic approach. *Rev Esp Enfrm Dig* 2002; 94: 537-43.
- Toni L Stom-Dickerson, Mark C Horattas. What have we learned over the past 20 years about appendicitis in the elderly? *Am J Surg* 2003; 185: 198-201.
- Liu CD, Mc Fadden DW. Acute abdomen and appendicitis. In: Greenfield LJ, Mulholland MW, (eds) *Surgery: Scientific Principles and Practices*. 2nd ed. *Baltimore, Md: Williams & Wilkins*: 1997: pp 1246-61.
- Doraiswamy NV. Leucocyte count in diagnosis of Acute appendicitis in children. *Br J Surg* 1979; 66:782.
- Bower RJ; Bell MJ. Diagnostic value of White blood cell count and neutrophil percentage in the evaluation of abdominal pain in children. *Surg Gynec Obst* 1981; 152:425.
- Pypius EB, Evans DG, Hinrichs W. Tc-99m-HMPO White blood cell scan for diagnosis of acute appendicitis in patients with equivocal clinical presentation. *Ann Surg* 1997; 226: 58-65.
- Brooks DW; Killen DA. Roentgenography findings in Acute appendicitis. *Surgery* 1965; 57:377.
- Killen DA; Brooks DW. Gas filled appendix: A Roentgenographic sign of acute appendicitis. *Ann Surg* 1965; 161:474.
- Lee SL, Walsh AJ, Ho HS. Computed tomography and ultrasound do not improve and may delay the diagnosis and treatment of acute appendicitis. *Arch Surg* 2001; 136: 556-62.
- JH Lee, Yong Ki Jeong, Kwang BO Park *et al*. Operator Dependent Technique for Graded Compression Sonography to Detect the Appendix and Diagnose acute appendicitis. *AJR* 2005; 184: 91-97.
- Ooms HW; Koumans RK. Ultrasound in the diagnosis of Acute appendicitis. *Br J Surg* 1991; 78:315.
- AU Cariati A, Brignole E, Tonelli E *et al*. Lap or Open appendectomy: Critical review of the literature and personal experience. *Giornale di Chirurgia* 2001; 22: 353-57.
- Esposito C, Boriz P; Valla JS *et al*. Laparoscopic versus Open appendectomy in children: a retrospective comparative study of 2332 cases. *World J Surg* 2007; 31 (4): 750-55.
- Boris Kirshtein, Michael Bayme; Sergey Domchik. Complicated appendicitis:- laparoscopic or Conventional surgery. *World J Surg* 2007; 31; 744-49.
- Sanjay Kumar Bhasin, Satyendra Dhar. Mini-Appendectomy (An Experience of 100 Cases) *JK-Practitioner* 2005; 12: 11-13.
- Sanjay K Bhasin, Rajinder Kumar Nagar, J.G Langer. Mini-Appendectomy. *JK-Sciences* 2005; 7: 94-96.