Chapter 1

The Dilemma of Acute Appendicitis

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Abstract

Acute appendicitis is one of a relatively dwindling number of conditions in which a decision to operate may be based solely on clinical findings. Regular re-assessment of patients and making use of the investigative options available will meet the standard of care expected by patients with acute abdominal pain. In this article, the greater importance of history and examination over investigations in the early diagnosis of acute appendicitis is emphasized. The ability to identify the presence of peritoneal inflammation probably has the greatest influence on the final surgical decision.

Keywords: acute appendicitis, assessment, differential diagnosis, management, outcome

1. Introduction

Acute appendicitis is the most common cause of the acute abdomen requiring surgery with a life-time risk of ~7%, which is maximal in childhood and declines steadily with age as the lymphoid tissue and vascularity atrophy [1, 2]. Surgery for the acute abdomen caused by appendicitis only evolved when the mortality associated with perforated appendicitis was found to be high. Conservative treatment with later drainage of any abscess had been the standard and diffuse peritonitis was usually fatal. Although only few patients progressed to the potentially lethal complications, early surgery for all patients with suspected appendicitis became the definitive method of preventing severe peritoneal sepsis [2–4]. Although a study demonstrated that simple appendicitis may be treated with antibiotics only, there is a risk of recurrent attacks [4]. Recent advances in interventional radiological techniques for peritonitis have significantly reduced the morbidity and mortality of physiologically severe complicated abdominal infection [5]. However, when there is clinical suspicion of the acute

abdomen, the best policy is early surgery if diagnostic tools are not readily available. The mortality of perforated viscus increases with delay in diagnosis and management, and it is greatest in the elderly and those ill from intercurrent disease with a poor performance status (ASA score) [2, 6–9].

2. Natural history

The natural history of acute appendicitis left untreated is that it will either resolve spontaneously by host defenses or progress to a fatal suppurative necrosis (gangrene) with perforation. The appendicular artery is a single end artery closely applied to the wall distally, and secondary thrombosis is common giving rise to gangrene which explains the short progressive history (3–5 days) of appendicitis and the poorer prognosis with the artherosclerosis of the aged. The classical presentation is referred, dull, poorly localized, colicky periumbilical pain (visceral) from the luminal obstruction (mid-gut origin) for 12–24 hours that shifts and localizes to the right iliac fossa as peritoneal irritation by the inflamed appendix occurs (somatic pain). There is nausea but vomiting more than twice is rare. A low grade pyrexia and constipation is usual [2]. An alternative outcome is that the appendix becomes surrounded by a mass of omentum or adjacent viscera which walls off the inflammatory process and prevents inflammation spreading to the abdominal cavity yet resolution of the condition is delayed (appendix mass). Such a patient usually presents with a longer history (a week or more) of right lower quadrant abdominal pain, appears systemically well and has a tender palpable mass in the right iliac fossa. Conservative management risks a 30% recurrence of acute inflammation [3, 8, 10]. Subacute obstruction may occur in the elderly and the appendix mass may be confused with a caecal carcinoma, Crohn's disease, tuberculosis or an ovarian tumour. However, a mass is often detected only after the patient has been anaesthesized and paralysed. Thus, the differentiation of a phlegmonous mass from an abscess is not a practical problem because surgery is the correct management for both. Such a policy renders any debate on interval appendicectomy redundant [3]. The operation which may be an appendicectomy, an ileocaecal resection or a hemicolectomy if indicated during the first admission is expeditious and safe, provided steps are taken to minimize postoperative sepsis [2, 3, 11]. The serious consequences of missing a carcinoma in the elderly patient are abolished [3].

3. Clinical assessment

Just as appendicitis should be considered in any patient with abdominal pain, virtually every other abdominal emergency can be considered in the differential diagnosis of suspected appendicitis. Clues to the differential diagnosis include recent sore throat (mesenteric adenitis), previous episode (Crohn's disease), weight loss (Crohn's disease, caecal carcinoma), dyspepsia (cholecystitis, perforated ulcer), arthralgia (*Yersinia enterocolitica*, Crohn's disease), vaginal discharge (salpingitis), mid-menstrual cycle (ruptured follicular cyst), frequency (urinary tract infection), preserved appetite (non-specific, or gynaecological) and

Asian origin (ileocaecal tuberculosis) [3]. In acute appendicitis the point of maximum tenderness (*McBurney's point*) usually lies one-third along a line from the anterior superior iliac spine to the umbilicus which denotes the surface anatomy of the appendix. This is associated with guarding of the inflamed area from being prodded further [2, 12, 13]. Although not of diagnostic value as being non-specific, pressure in the left iliac fossa produces pain in the right iliac fossa (*Rovsing's sign*) [14]. Occasionally, patients with appendicitis have signs of widespread peritonitis, which obscure the area of maximal tenderness. Reexamination, after resuscitation and adequate analgesia, permits more reliable localization of signs [2, 3, 13, 14]. The appendix can occasionally be in different positions within the abdomen and can lead to the pain localizing in more unusual places, which may lead to a delay in diagnosis. A retrocaecal appendix can give rise to tenderness in the right upper quadrant, whereas a pelvic appendix may be associated with central abdominal discomfort. Passive extension or hyperextension of the hip increases the abdominal pain because of an inflamed appendix lying on the psoas muscle (*Psoas stretch test*). The *obturator sign* is positive when passive internal rotation of the hip aggravates the pain of an inflamed appendix lying on the obturator internus, but, an ovarian pathology may do same [2, 3, 15]. Left-sided appendicitis is a rare and atypical presentation associated with congenital midgut malrotation, situs inversus or an abnormally long appendix [16]. The apex beat of the heart on the right side will betray the diagnosis if there is associated dextrocardia. When rebound tenderness is detected in the lower abdomen, further examination by rectal examination has been shown to provide no new information. Rectal examination is reserved for those patients without rebound tenderness or where specific pelvic disease needs to be excluded. It is of little value in the diagnosis of acute appendicitis even when the organ lies in the pelvis [17]. The demonstration and interpretation of these physical signs are skills that fade without practice. The age, sex and personality of the patient are important modifiers of clinical signs; the most typical cases occur in older children (5–15 years) of either sex and in young males with poor dietary fibre being a risk factor. In other individuals, the features are more obscure, and the potential for alternative pathology is greater [2, 3]. It is, however, not possible to practice fully the ideal management of early diagnosis and surgery for the acute abdomen, thus reducing morbidity and mortality to zero, because patients and the disease are variable. Nevertheless, because infection, inadequate tissue perfusion and a persistent inflammatory state are the most important risk factors for development of multiple organ failure, it seems logical that initial therapeutic efforts should be directed at their early treatment or prevention (early goal-directed therapy). The risk of portal pyaemia from septic emboli is also decreased [10]. It is important to recognize the features of the acute abdomen which would indicate the need for resuscitation in the high dependency or intensive care unit [11]. The attitude of the patient with advanced peritonitis is best described by Hippocrates (460–370 B.C.) as one with a 'sharp nose, hollow eyes, collapsed temples, the ears cold' now known as the *Hippocratic facies*. The patient is usually ill and clammy, hypotensive with a rapid thready pulse. The patient will lie perfectly still to minimize discomfort, the abdomen held totally rigid as the patient takes rapid shallow breaths using chest movements only [18].

4. Any role for the Alvarado score?

The Alvarado score was designed more than two decades ago as a diagnostic score using the clinical features of acute appendicitis for subsequent clinical management but the appropriateness for its routine clinical use is still unclear (**Table 1**) [19]. A recent meta-analysis showed its positive role in 'ruling out' appendicitis but not in 'ruling in' the diagnosis without surgical assessment and further diagnostic testing. It is inconsistent in children and over-predicts the probability of acute appendicitis in women [20]. Alvarado scoring may be valuable in low-resource or primary care centres where imaging is not an option.

Symptoms	Migration	1
	Anorexia-acetone	1
	Nausea-vomiting	1
Signs	Tenderness in right lower quadrant	2
	Rebound pain	1
	Elevation of temperature	1
Laboratory	Leukocytosis	2
	Shift to the left	1
Total score		10

A score of 5 or 6 is compatible with the diagnosis of acute appendicitis. A score of 7 or 8 indicates a probable appendicitis, and a score of 9 or 10 indicates a very probable appendicitis.

Table 1. Mnemonic for the diagnostic score of acute appendicitis.

4.1. Any role for special investigations in appendicitis?

There are no special investigations to confirm appendicitis. As no test is accurate, the diagnosis has to rely on clinical symptoms and signs [2, 3, 18]. Tests should serve as adjuncts to clinical diagnosis and may help to exclude alternative diagnoses especially in the female or the elderly [3]. A white cell count is usually elevated but a normal white cell count does not exclude appendicitis [19, 20]. The appendicolith, a radio-opaque concretion located within the appendix, which is deemed to be the most specific finding of appendicitis on plain radiographs, is visualized in only 5–15% of patients with appendicitis [21]. Ultrasonography in expert hands is perhaps the most useful investigation [2, 3, 21]. Although computed tomography (CT) scan is superior to ultrasound (US) scan, the risk of radiation-induced malignancy renders it not of particular use in paediatric patients [21]. Laparoscopy is essentially an operation rather than an investigation. However, the continuing development of ultrasound techniques and laparoscopic surgery have both prompted the view that the proportion of normal appendices removed (20%) is unacceptably high [22]. Although it is clearly advantageous to spare patients from unnecessary surgery, the morbidity and mortality of failing to diagnose appendicitis until perforation has occurred is greater than that associated with removal of normal appendix [2, 3].

4.2. If diagnostic tools not readily available

The best policy is early surgery when there is clinical suspicion of acute appendicitis. If the appendix is macroscopically normal, the terminal 60 cm of ileum must be delivered to exclude a Meckel's diverticulum, terminal ileitis and mesenteric adenitis. If the base of the appendix and caecum are healthy, the appendix must be removed when ileitis is present [2, 3]. Biopsy and culture of inflamed nodes aids a diagnosis of *Yersinia* infection. The right ovary and tube must be visualized. Extension of the incision, a head down tilt and adequate retraction may be required. Occasionally, fluid leaking from a perforated peptic ulcer down the right paracolic gutter produces clinical findings resembling those of acute appendicitis. A classical appendicectomy incision would reveal bile-staining free peritoneal fluid and a second upper abdominal incision is usually required. Purulent fluid tracking down the right paracolic gutter may also suggest acute cholecystitis. If clinical diagnosis is equivocal despite investigations, it is best to begin with a low midline incision which could be extended if there is evidence of a perforated peptic ulcer [2, 23].

5. The diagnostic dilemma

5.1. The young woman

It is not surprising that women have the highest appendicectomy rate with 30% revealing normal appendices [16, 24]. In young women, various gynaecological conditions are present with lower abdominal pain, and the history gives important clues. Vaginal discharge, a longer history (often more than 72 hours) and absence of gastrointestinal upset raise the possibility of pelvic inflammatory disease. A bilateral, low distribution of pain aggravated by cervical movement support the diagnosis [24]. Abrupt onset of pain suggests rupture of a follicle, cyst or ectopic gestation [25]. The condition of *Curtis-Fitz-Hugh syndrome* when transperitoneal spread of pelvic inflammatory disease produces pain in right upper quadrant due to perihepatic adhesions is now well recognized, and care must be taken to distinguish this from acute biliary conditions [25]. Early recognition with diagnostic laparoscopy and appropriate treatment of pelvic inflammatory disease may help to avoid potentially serious longer term sequelae and must be encouraged. Many studies have now demonstrated that laparoscopy significantly improves surgical decision-making in patients with acute abdominal pain especially in the young woman [16, 22, 24].

5.2. Chronic appendicitis or 'the grumbling appendix'

Patients with true relapsing or chronic appendicitis are rare, and often it is difficult to diagnose as the symptoms may be atypical and short-lived. In genuine cases, the macroscopic appearance of the appendix is abnormal, and thus the diagnosis is best established by laparoscopy, following which the appendix can be removed [22]. Minor frequent episodes of right iliac fossa pain 'the grumbling appendix' can be caused by thread worms in the appendix or by some conditions other than the appendix. Chronic pain with evidence of organic disease (weight

loss, elevated erythrocyte sedimentation rate (ESR)) is usually due to Crohn's disease at any age, caecal carcinoma in the elderly or lymphoma or tuberculosis in endemic areas [2, 22, 23]. Pain without signs or abnormal investigations is likely to be due to irritable bowel syndrome, but small bowel studies are still warranted if pain persists, to exclude more unusual causes [3].

5.3. The pregnant woman

Acute appendicitis is the most common general surgical problem encountered during pregnancy confirmed in 1:800 to 1:1500 pregnancies [26]. Difficulty in diagnosis, reluctance to operate a pregnant women and avoidable delay account for the high risks of appendicitis in pregnancy. In pregnancy, the enlarging uterus progressively displaces the appendix up into the right hypochondrium. Delay is so harmful to mother and unborn child that provided urinary tract infection has been excluded, one should operate early. Maternal and fetal deaths do not result from appendicectomy but from peritonitis following perforation. The risk of maternal mortality increases as pregnancy progresses [27].

5.4. The elderly and the infant

Appendicitis has a more rapid course in the elderly as artherosclerosis, gangrene and perforation are common. Its atypical presentation adds to the delay in diagnosis [9]. A diagnosis of carcinoma of the caecum or lymphoma, which has obstructed the appendix, must be considered and excluded by CT scan [3]. Diagnosis of acute appendicitis may be difficult in infants. Delay in diagnosis is common because the classical signs and symptoms may be absent or unobtainable, and perforation is common as host defenses including the omentum are not fully developed. The development of fever associated with any abdominal tenderness should always raise the suspicion of acute appendicitis [2, 21]. 'Active observation' is safe and effective in early appendicitis and in patients where the diagnosis is in doubt. It permits differentiation between patients with persistent or progressive signs requiring surgery and those with non-specific pain or alternative pathology [3, 28]. Deliberate delay allows time for the results of appropriate investigations to be reviewed, and it is extremely rare for such an appendix to rupture during observation and the diagnosis will usually become apparent within 12–24 hours [29].

5.5. The AIDS patient

Abdominal pain is common in patients with AIDS, but less than 1% of patients with AIDS will need an emergency laparotomy [30]. The commonest disease processes, *cytomegalovirus* (CMV) colitis, B-cell lymphoma, acute appendicitis (CMV-associated) and atypical mycobacterial infection are quite different from those in the non-HIV population. These patients are difficult to manage as it is often unclear whether they need an immediate laparotomy. It is crucial to have close liaison between AIDS physicians and AIDS surgeons to exclude pre-terminal cases and keep down negative laparotomies to acceptable rate. Appendicectomy and colectomy are the commonest abdominal operations in AIDS patients [31]. Being an extranodal lymphoid organ appendicitis could be the only initial indication of a lymphoma or lymphadenopathy from *Myocobacterium avium-intracellulare* obstructing the appendiceal ostium. Thus appendi-

cectomy specimens should routinely be examined histologically [32]. With careful patient selection, emergency laparotomy confers worthwhile palliation [30, 31, 33]. However, some patients (and their families) refuse surgery in desperate situations (such as bowel perforation) as they want an end to the suffering [31, 33].

6. Conclusions

A precise history of the acute abdomen may indicate the pathology, and physical examination may indicate where the pathology is. However, the ability to identify the presence of peritoneal inflammation probably has the greatest influence on the final surgical decision. The best policy is early surgery when there is clinical suspicion of the acute abdomen if diagnostic tools are not readily available, but 'active observation' is effective and safe in early appendicitis. Regular re-assessment of patients and making use of the investigative options available will meet the standard of care expected by patients with acute abdominal pain.

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References

[1] Ergul E. Importance of family history and genetics for the prediction of acute appendicitis. Internet J Surg 2007, 10:2.

[2] Krukowski ZH, O'Kelly TJ. Appendicitis. Surgery 1997, 15:76–81.

[3] Bailey I, Tate JJT. Acute conditions of the small bowel and appendix (including perforated peptic ulcer) pp:187–212. In: Patterson-Brown S (ed), Emergency surgery and critical care. A companion to Specialist Surgical Practice 1997 WB Saunders Company ltd : 24-28 Oval Road London NW1 7DX.

[4] Fitzmaurice GJ, McWilliams B, Hurreiz H, Epanomertakis E. Antibiotics versus appendectomy in the management of acute appendicitis: a review of the current evidence. Can J Surg 2011, 54(5):307–314.

[5] Solomon J, Mazuski J. Intraabdominal sepsis: newer interventional and antimicrobial therapies. Infect Dis Clin N Am 2009, 23: 593–608.

[6] Marshall JC, Maier RV, Jimerz M et al. Source control in the management of severe sepsis and septic shock: an evidence-based review. Crit Care Med 2004, 32:5513–5526.

[7] River SE, Nguyen B, Haystd S, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Eng J Med 2001, 345:1368–1377.

[8] Baigrie RJ, Dehn TCB, Fowler SM, Dunn DC. Analysis of 8651 appendicectomies in England and Wales during 1992. Br J Surg 1995, 82:933.

[9] Hardy K, Ackermann C, Hewitt J. The acute abdomen in the older person. Scott Med J February 2013, 58:41–45.

[10] Marik PE. Surviving sepsis: going beyond the guidelines. Ann Intensive Care 2011; 1(1): 17.

[11] Weledji EP, Ngowe NM. The challenge of intraabdominal sepsis. Int J Surg 2013, 11(4): 290–295.

[12] Gallegos N, Hobsley N. Abdominal pain: parietal or visceral. J R Soc Med 1992, 85:379.

[13] Bennett DH, Tambeur LJMT, Campbell WB. Use of coughing test to diagnose peritonitis. Br Med J 1994, 308:1336–1337.

[14] Smith PH. The diagnosis of appenicitis. Postgrad Med Journ 1965, 41:2–5.

[15] Stevens L, Kenney A. Emergencies in Obstetrics and Gynaecology. Oxford University Press, Oxford, 1994.

[16] Yang CY, Lin HY, Lin HL, Lin JN. Left-sided acute appendicitis: a pitfall in the emergency department. J Emerg Med 2012, 43(6):980–982.

[17] Dixon JM, Elton R. Rectal examination in patients with pain in the right lower quadrant of the abdomen. Br Med J 1991, 302:386–388.

[18] Bailey H, Bishop WJ. The Hippocratic facies. In: Notable names in Medicine and Surgery 3rd Edn 1959. Published by H.K. Lewis & Co. Ltd. London 1959.

[19] Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med 1986, 15(5):557–564.

[20] Ohle R, O'Reilly F, O'Brien KK, Fahey T, Dimitrov BD. The Alvarado score for predicting acute appendicitis: a systematic review. BMC Med 2011, 9:139.

[21] Brennan GDG. Paediatric appendicitis: pathophysiology and appropriate use of diagnosing imaging. Can J Emerg Med 2006, 8(6):425–432.

[22] Paterson-Brown S, Eckersley JRT. Laparoscopy as an adjunct to decision-making in the acute abdomen. Br J Surg 1986, 73:1022–1024.

[23] Paterson-Brown S. Diagnosis and investigation in the acute abdomen. In: Paterson-Brown S (ed), Emergency Surgery and Critical Care. A Companion to Specialist Surgical Practice. W.B.Saunders, 1997.

[24] Pearce JM. Pelvic inflammatory disease. Br Med J 1990, 300:1090–1091.

[25] Gatt D, Heafield T, Jantet G. Curtis–Fitz-Hugh syndrome: the new mimicking disease. Ann R Coll Surg Eng 1986, 68:271–274.

[26] Andersen B, Nielsen TF. Appendicitis in pregnancy: diagnosis, management and complications. Acta Obstet Gynecol Scand 1999, 78:758.

[27] Mourad J, Elliott JP, Erickson L, Lisboa L. Appendicitis in pregnancy: new information that contradicts long-held clinical beliefs. Am J Obstet Gynecol 2000, 182:1027.

[28] Thompson HJ, Jones PF. Acute observation in acute abdominal pain. Am J Surg 1986, 132:522–555.

[29] Moss JG, Barrie Jl, Gunn AA. Delay in surgery for acute appendicitis. J R Coll Surg Edinb 1985, 30:290–293.

[30] Dua RS, Wajed SA, Winsler MC. Impact of HIV and AIDS on surgical practice. Ann R Coll Surg Engl 2007, 89:354–358.

[31] Smit S. Guidelines for surgery in the HIV patients (Continuous Medical Education (CME): August 2010, 28, No 8.

[32] Weledji EP, Ngowe MN, Abba JS. Burkitt's lymphoma masquerading as acute appendicitis–two case reports and review of the literature. World J Surg Oncol 2014, 12:187.

[33] Weledji EP, Nsagha D, Chichom AM, Enoworock G. Gastrointestinal surgery and the acquired immune deficiency syndrome. Ann Med Surg (Lond) 2015, 4(1):36–40.

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