Appendicitis in cystic fibrosis

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Abstract

Appendicitis is said to be uncommon and difficult to diagnose in cystic fibrosis. The clinical and radiological features in nine patients with cystic fibrosis who had appendicitis were studied. All but one of the patients had an appendiceal abscess at surgery. Four patients had a delay in diagnosis of greater than three days before the correct diagnosis was made. This delay may have been due to a more indolent presentation or because these patients were initially considered to have distal intestinal obstruction syndrome. Appendicitis should be considered in the differential diagnosis if a contrast enema demonstrates extrinsic compression of the caecum. Ultrasound, computed tomography, and gallium scans were found to be of limited help in our series.

Abdominal pain is a common symptom in patients with cystic fibrosis, and is most frequently due to the distal ileal obstruction syndrome (DIOS).[1] Other conditions, such as intussusception, volvulus, pancreatitis, and faecaliths are also recognised causes of lower abdominal pain in the population with cystic fibrosis and may be difficult to differentiate from DIOS.[2] In contrast, the incidence of acute appendicitis is thought to be low among patients with cystic fibrosis, so that when it does occur the diagnosis may be overlooked until appendiceal perforation and abscess formation have occurred.[3–6] Indeed, these complications may only be recognised as 'incidental' findings at laparotomy or even necropsy.[7–9] Previous reports advocate the use of contrast enemas in differentiating an appendix abscess from DIOS, and modern diagnostic methods, such as ultrasound, radionuclide (gallium) scanning, and computed tomography of the abdomen are recommended for diagnosing intra-abdominal abscesses.[10–13] We describe our experience with appendicitis and its complications in a group of patients with cystic fibrosis and the diagnostic value of radiographic procedures in these patients.

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Patients and results

During the 10 year period, 1979–89, six of 803 patients with cystic fibrosis being followed up at the Hospital for Sick Children, Toronto, were identified from the hospital's medical record's computer as having undergone appendicectomy. Three other patients with cystic fibrosis had appendicectomies carried out at other hospitals. The clinical presentation and the laboratory and radiological data of these nine patients (five males) were reviewed retrospectively.

CLINICAL PRESENTATION

The patients' characteristics are summarised in the table. All of the patients had pancreatic insufficiency and were taking enzymes; four had meconium ileus at birth, three of whom required surgical resection. Eight of the nine patients were on long term prophylactic antibiotics: cloxacillin (n=4), cephalexin (n=2), or clindamycin (n=2). The mean (SD) forced expiratory volume in one second (FEV_1) of the seven patients old enough to perform pulmonary function testing was 69 (23)% predicted. The respiratory tract in all of the patients was colonised by *Pseudomonas aeruginosa* and in addition, three were colonised by *Pseudomonas cepacia*.

Five of the nine patients underwent appendicectomy within three days of the onset of symptoms. Although two of these patients were diagnosed as having DIOS on admission to hospital, they rapidly developed the classical features of acute appendicitis. In only one of these five patients was there a recent history of recurrent DIOS with a mass in the right iliac fossa. However, this patient was clinically diagnosed as having appendicitis while in the emergency room.

In the remaining four patients considerable diagnostic difficulties were encountered with 5, 25, 45, and 56 days intervening respectively from the onset of symptoms and the time of surgery. Three of these patients had recently been treated for DIOS, and had been noted previously to have masses in the right iliac fossa. All three were diagnosed initially as having recurrent DIOS, and the possibility of an alternative diagnosis was considered only when they failed to respond to medical treatment for DIOS. The fourth patient with delayed diagnosis was initially thought to have a primary psoas abscess. During an emergency admission for bleeding oesophageal varices, he complained of pain in the right hip, and was noted to hold this hip flexed and abducted. He was treated with intravenous antibiotics, to which he only had a partial response.

LABORATORY AND RADIOGRAPHIC DATA

The average white cell count on admission was $13{\cdot}9\times10^9$/l (range 7·5–21·0), with a mean polymorphonuclear cell count of $9{\cdot}9\times10^9$/l (range 3·5–15·5).

Clinical data of the nine patients

Patient No	Age (years)	Presence of meconium ileus	Previous DIOS	Duration of symptoms in days*	Symptoms	Signs	Initial diagnosis	Radiological investigations
1	14	No	No	2 (1)	Constant right iliac fossa pain, fevers and chills, nausea and anorexia, no change in stool frequency	Temperature=37·8°C, right iliac fossa tenderness, guarding and rebound, right iliac fossa mass palpable, bowel sounds normal	DIOS	Plain abdominal radiograph, contrast enema
2	6	Yes	No	1 (2)	Crampy right iliac fossa pain, no fevers, nausea, vomiting, anorexia, and constipation	Temperature=37°C, right iliac fossa tenderness and guarding, right iliac fossa mass palpable, able to walk about	DIOS	Plain abdominal radiograph
3	26	No	Yes	2 (>1)	Crampy right iliac fossa pain, nausea and vomiting, no fevers, no change in stool frequency	Temperature=37·8°C, right iliac fossa tenderness and guarding, right iliac fossa mass palpable	Appendicitis	Plain abdominal radiograph
4	17	Yes	No	1 (<1)	Crampy right iliac fossa pain, constipation, fevers	Temperature=38·5°C, right iliac fossa tenderness, guarding, and rebound, absent bowel sounds, no mass	Appendicitis	—
5	14	No	No	2 (<1)	Right iliac fossa pain, diarrhoea, fever	Temperature=37·3°C, right iliac fossa tenderness and rebound: no mass, bowel sounds normal	Appendicitis	—
6	23	No	Yes	2 (3)	Constant right iliac fossa pain, fevers and chills, nausea, vomiting, anorexia, and constipation	Temperature=39·0°C, right iliac fossa tenderness, guarding, and rebound, right iliac fossa mass palpable, able to walk about	DIOS	Plain abdominal radiograph, contrast enema, abdominal ultrasound scan
7	4·5	Yes	Yes	22 (3)	Crampy right iliac fossa pain, no fever, nausea, anorexia, and constipation	Temperature=36·0°C, right iliac fossa tenderness, masses palpable in both right iliac fossa and left lower quadrant of abdomen, able to walk about	DIOS	Plain abdominal radiograph, contrast enema, abdominal ultrasound scan
8	13	Yes	No	5 (40)	Right hip pain, unable to walk, no fevers, no nausea, haematemesis from varices	Temperature=37·0°C, no abdominal pain, right hip flexed and abducted	Psoas abscess	Plain abdominal radiograph, contrast enema, abdominal ultrasound scan, abdominal computed tomogram
9	35	No	Yes	9 (47)	Constant right iliac fossa and suprapubic pain with dysuria, fevers and chills, no change in stool frequency	Intermittent fevers up to 39·0°C, right iliac fossa tenderness, guarding, and rebound, right iliac fossa mass palpable, able to walk	DIOS	Plain abdominal radiograph, contrast enema, abdominal ultrasound scan, abdominal computed tomogram, gallium scan

*Symptom duration before presentation to hospital (time interval between hospital admission and time of surgery).
DIOS=distal intestinal obstruction syndrome.

Plain abdominal radiographs were performed in seven patients and in four patients faecal impaction of the colon and caecum was evident. Three patients had small bowel air-fluid levels and in one of these the small bowel was minimally dilated. The abdominal radiograph of the patient thought to have a psoas abscess showed a prominent psoas shadow and a few air-fluid levels in the small bowel near to the caecum.

Contrast enemas were performed in all of the patients with a delayed diagnosis and in one other patient. In three of these, the caecum was noted to be loaded with faeces, and in one patient the caecum was also indented by an extrinsic mass. Indentation of the caecum, without faecal impaction, was noted in another case, and the remaining study showed an irregularity of the caecum. In no case was filling of the appendix with contrast demonstrated.

Ultrasound scans of the abdomen were performed in the four patients with delayed diagnosis. Two of these scans were reported as normal, and one scan showed a mass in the right iliac fossa that was thought to be faeces, although a periappendicular mass could not be excluded. The ultrasound scan of the patient presenting with limited hip movement showed an enlarged right psoas muscle with surrounding fluid extending to the caecal region, and was interpreted as a primary psoas abscess. An abdominal computed tomogram was performed on two patients: that of patient 8 was also consistent with a psoas abscess, and the other was performed in patient 9 and was reported as normal. This patient also had two gallium scans of the abdomen, the first was normal, and the repeat showed diffuse radionuclide uptake in the lower abdomen and pelvis.

SURGICAL FINDINGS

The decision to perform an appendicectomy in patients 1–5, was based on clinical deterioration and the development of the classical features of

appendicitis with peritoneal irritation. With respect to the four patients with delayed diagnosis, a laparotomy was performed in two of these patients when they failed to respond to medical treatment for DIOS and fever, toxicity, and peritoneal irritation developed. Although the results of ultrasound and computed tomography in patient 9 were normal, he eventually underwent a laparotomy because of persistent fever and pain in his right iliac fossa with a palpable mass. Although the patient with a suspected psoas abscess had a partial response to intravenous antibiotics, a repeat contrast enema revealed an inflamed and fibrosed small bowel proximal to the caecum (possibly representing the appendix), and a repeat computed tomogram showed a residual abscess in the psoas region. He underwent an interval appendicectomy two months later.

All but one (patient 5) of the children had periappendicular abscesses identified at surgery. In addition, one patient had a perforated appendiceal diverticulum. Bacterial cultures from the abscess fluid were available in five patients and the following organisms were grown: *Escherichia coli* (n=2), *P aeruginosa* (n=1), bacteroides (n=1), and no growth in one case. All of the patients survived surgery.

Discussion

Despite the fact that the appendix in patients with cystic fibrosis is frequently swollen and distended with inspissated eosinophilic secretions, it is ironic that the reported incidence of acute appendicitis in these patients is lower than that in the general population.[3–8] During the past 10 years, only nine of 803 (1·1%) patients attending this cystic fibrosis clinic have developed appendicitis. Likewise, McCarthy *et al* reported an incidence rate for appendicitis among patients with cystic fibrosis of 1–2% compared with a 7% rate in the general population.[4] These authors suggested that the low incidence of appendicitis among patients with cystic fibrosis may be related to a protective effect of mucous secretions within the appendix, which maintain the appendiceal lumen distended and less prone to total luminal occlusion and acute inflammation. It is also possible that the long term use of oral antibiotics for pulmonary prophylaxis accounts for the low incidence of appendicitis in cystic fibrosis and masks the symptoms of appendicitis.[4 5]

Our report highlights the difficulty with which the diagnosis of appendicitis is made in patients with cystic fibrosis, and this has also been the experience of others.[2–6] Several factors account for the delay in diagnosis in our patient group. In general, the history and physical findings of our patients on presentation were less 'dramatic' and impressive than seen in patients without cystic fibrosis who develop acute appendicitis, and this may in part have been related to long term antibiotic use.[4 5] In one patient the diagnosis was overlooked initially because of a very atypical presentation and radiological findings suggestive of a primary psoas abscess. In our experience, however, the main reason for the delay in the diagnosis of appendicitis was that five of our patients were initially considered as having DIOS, which occurs in 4% of our clinic population.[1] The presenting history and physical findings (particularly that of a mass in the right iliac fossa) certainly made the diagnosis of DIOS a distinct possibility in these patients, and in addition, all of the patients were pancreatic insufficient and four had a history of DIOS. The picture was confused further by the finding of faecal impaction of the caecum on plain abdominal radiographs and ultrasound scans in some of our patients, again consistent with the diagnosis of DIOS.[1]

As a result of the delay in reaching the correct diagnosis, appendiceal perforation and abscess formation was found in all but one of our patients at the time of surgery. Interestingly, three of the four patients described by Jaffe *et al*,[3] and all of the 10 patients reported by Dalzell *et al*,[2] McCarthy *et al*,[4] and Holsclaw and Habboushe,[5] were also found to have periappendiceal abscesses at surgery. Appendiceal perforation was noted in 13 of 34 patients described recently by Coughlin *et al*.[6] One of our patients was noted to have an appendiceal diverticulum, a lesion which is considered to be more common in patients with cystic fibrosis.[14]

A variety of modern radiographic techniques have been recommended in order to differentiate the common causes of abdominal symptoms with a right iliac fossa mass in cystic fibrosis patients—that is, DIOS, intussusception, faecalith, and appendiceal abscess.[4 11 12] In our series four patients had ultrasound examinations, two had computed tomograms, and one had a gallium scan, none of which was helpful in reaching a diagnosis of periappendiceal abscess. Contrast enemas were performed in five of our patients for diagnostic as well as therapeutic (for DIOS) reasons. The contrast studies were helpful in the sense that they did rule out the possibility of intussusception. In three of these five studies, however, faecal impaction of the caecum was found that led initially to the mistaken diagnosis of DIOS (in one of these studies caecal indentation by an extrinsic mass was also noted). The other two patients who underwent contrast enemas were found to have an extrinsic indentation of the caecum and a caecal irregularity respectively. The patient with the extrinsic compression of the caecum was initially thought to have a primary psoas abscess, a suspicion which was further supported by an abdominal ultrasound scan and computed tomography. The patient with caecal irregularity on contrast enema had normal results on computed tomography, ultrasound and gallium scans of the abdomen (patient 9). This patient experienced the longest delay before a diagnosis of appendiceal abscess was reached at laparotomy, which was performed in view of persistent symptoms and diffuse uptake of gallium over the lower abdomen on a repeat scan.

In summary, the diagnosis of appendicitis and its complications is difficult in patients with cystic fibrosis, despite the availability of modern radiographic techniques. Although DIOS remains the most common cause of abdominal pain and a mass in the right iliac fossa in cystic

fibrosis patients, our cases indicate that an appendix abscess may mimic this condition. This diagnosis should be considered particularly in patients who fail to respond to medical treatment for DIOS, and who are found to have an extrinsic caecal compression on contrast enema.

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On the trail of the Lone Star tick

The Lone Star tick (*Amblyomma americanum*) lives in the south and east of the United States and is most likely to bite you in spring and early summer. It is known to be a vector, though not the most common one, of Rocky Mountain spotted fever but is now suspected of harbouring a newly described rickettsial disease, ehrlichiosis. The diagnosis can be confirmed serologically in fewer than a quarter of people suspected of having Rocky Mountain spotted fever. The differential diagnosis of fever after tick bite includes tularaemia, Lyme disease, babesiosis, and now ehrlichiosis.[1] A recent paper in the *Journal of the American Medical Association* (Eng *et al*, *JAMA* 1990; **264**: 2251–8) gives details of the clinical and laboratory findings in this disease which is thought to be caused by the rickettsia *Ehrlichia canis*, though the organism has not been isolated from patients and the diagnosis depends on demonstrating a fourfold rise in antibody titre in paired sera. Samples sent to laboratories throughout the United States for testing for Rocky Mountain spotted fever were also tested for ehrlichiosis and 40 of 541 paired samples proved positive. Seven were from children.

The disease follows the tick bite by about seven days on average (range 1–21 days) and is characterised by prolonged fever with recovery after about three weeks in children, who generally have a less severe illness than adults. All children, but only a third of adults, develop a rash on the trunk and/or extremities that is either maculopapular or petechial. Diarrhoea and pulmonary infiltrates on *x* ray each occurred in about three quarters of the children and hepatosplenomegaly in a third. Lymphadenopathy, anaemia, leukopenia, and thrombocytopenia were common as was a raised serum transaminase. Treatment with either a tetracycline or chloramphenicol was effective but cephalosporins, penicillins, erythromycin, or co-trimoxazole not so.

These diseases have a fascination of their own, but it is said that the United States is about to take over from Spain the sometimes dubious privilege of being the most favoured destination of British holidaymakers. As many of those may head for the south eastern corner of the country it is not impossible that the trail of at least one Lone Star tick might end on a British children's ward.

ARCHIVIST

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