Acute Appendicitis in Adults: Current Concept of Diagnosis and Management

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Author’s contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Article Information

Editor(s):
(1) Dr. Sarah Ralte, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, India.
(2) Dr. John K. Triantafillidis, IASO General Hospital, Greece.

Reviewers:
(1) Kofina Konstantinia, Democritus University of Alexandroupolis, Greece.
(2) Apollon Zygomatas, University of Patras, Greece.
(3) Leonard Derkyi-Kwarteng, University of Cape Coast, Ghana.
Complete Peer review History: http://www.sdiarticle4.com/review-history/56863

Received 23 March 2020
Accepted 29 May 2020
Published 03 June 2020

Mini-review Article

ABSTRACT

Appendicitis is a special type of inflammation form in the vermiform appendix lumen. It is part of most life-threatening cases. The obstruction and accumulation of bacterial in the lumen may be induced in the pathogenesis of appendicitis. This condition will develop worse if the patient nor getting treatment properly, as a physician we have to know about clinical manifestations, physical examination findings, laboratory tests and management. When antibiotic treatment is not changing the symptoms during the initial admission, surgery treatment might be considered to be performed. In recurrent disease, either a second course of antibiotics or appendectomy can be applied. The aim of this review, to explain the current concept of appendicitis on diagnosis approach and management.

Keywords: Appendicitis; adults; diagnosis; management.

1. INTRODUCTION

Acute appendicitis (AA) is a special type of inflammation and commonly found in the emergency department [1]. Clinicians from a wide world of medical specialities including internal medicine and surgeons, often facing the patient with AA in daily practice. It is relatively

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easy, when typical symptoms may occur. Unfortunately, young ages and elderly aged are often shown atypical symptoms, that may be delayed of diagnosis and treatment will be not properly [1]. The incidence of AA average about 90 to 100 patients per 100 000 per year in developed countries. The highest incidence occurs in the second or third decade of life. Previously study reported there was the highest risk of AA in the amount of 16% in South Korea, 9.0% in the USA, and 1.8% in Africa [2]. The lifetime risk of AA is highest in males than females population, however, the risk of undergoing appendectomy is much lower for males than for females (12 vs 23%) and it occurs most often between the ages of 10 and 30 years old, with a male: female ratio of 1.4:1 [3]. This review aims to provide an update about the existing in concept, and management of acute appendicitis.

2. DEFINITION

Appendicitis is a part of the inflammation condition inside the vermiform appendix [3]. It located 1.7 – 2.5 cm below the terminal ileum. The low part of appendix consists of three taeniae coli of the caecum, which fuses to form the outer longitudinal muscle of the appendix. The movement of majority appendix position such as 74% are retrocecal, 21% pelvic, 2% paracecal, 1.5% subcecal, 1% pre-ileal and 0.5% post ileal [2,4]. Patients may also have their appendix behind the ascending colon and liver, this position might occur atypical symptoms. Appendicitis will be complicated if not treating properly. That is why clinicians have to know well about the diagnosis and management of acute appendicitis [4].

3. PATHOLOGY OF ACUTE APPENDICITIS

Appendicitis occurs when present of obstruction in the lumen with the accumulation of bacterial normal intestine [5]. The obstruction may be induced by many mechanisms and it will be retention of mucus. When bacterial infection supervenes, the intraluminal pressure increases, it leading to obstruction of lymphatic flow and blood circulation that will be appendiceal oedema condition. This process leading to acute appendicitis when present of distension in the appendix and vascular congestion. Appendiceal oedema and vascular congestion might be progress to be of multiple abscesses in the wall lumen and purulent. This condition is called as phlegmonous appendicitis. Dysfunction of the appendiceal artery and veins leads thrombosis and infarctinthe junction between the meso-appendix and appendix, where the blood supply is inadequate. As a result, the appendix becomes congested dark red with black necrotic tissues, this condition as designated as gangrenous appendicitis [6]. If perforation present, appendicitis becomes complicated by peritonitis. Usually, peritonitis is localized, being confined to the ileocecal region. In young children, however, the omentum is not fully developed, so the clinical course is often complicated by diffuse peritonitis [6].

4. DIAGNOSIS OF ACUTE APPENDICITIS

4.1 Clinical Manifestations

Diagnosing acute appendicitis accurately by symptoms can reduce morbidity and mortality from perforation and further complications. The clinical manifestation of AA such as abdominal pain, fever, anorexia, vomiting, and mostly, the pain may occur in the upper abdomen at first, but it migrates to the right lower quadrant [7].

4.2 Finding on Physical Examination

Physical exam findings are often subtle, especially in early appendicitis. As inflammation progresses, signs of peritoneal inflammation develop. Signs include Right lower quadrant guarding and rebound tenderness over McBurney's point. In 1894, McBurney described a new technique for the management of acute appendicitis, this method is still used when an open approach is required [8,9]. Rovsing's sign (right lower quadrant pain elicited by palpation of the left lower quadrant), Dunphy's sign (increased abdominal pain with coughing). Other associated signs such as psoas sign (pain on external rotation or passive extension of the hip suggesting retrocecal appendicitis) or obturator sign (pain on internal rotation of the right hip suggesting pelvic appendicitis) are rare. The time course of symptoms is variable but typically progresses from early appendicitis at 12 to 24 hours to perforation at greater than 48 hours. 75% of patients present within 24 hours of the onset of symptoms. The risk of rupture is variable but is about 2% at 36 hours and increases about 5% every 12 hours after that [10].

4.3 Laboratory Tests

The laboratory tests for acute appendicitis such as white blood cell count (WBC) and C-Reactive protein (CRP) are of diagnostic value. But WBC
usually exceeds 10,000/mm³ [3]. In severe cases associated with diffuse peritonitis, however, the WBC may be decreased rather than increased, so, care must be taken. Although the CRP rises in appendicitis, the increase is not necessarily associated with the severity of inflammation [11].

The use of the Alvarado scoring system, which includes clinical examination findings and laboratory values, helps rule out appendicitis (Table 1). Score range from 1 to 10, with higher scores indicating a greater risk of appendicitis. When the score is less than 4, appendicitis is uncommon and imaging and other interventions can be avoided. When imaging is used, high-quality ultrasonography (USG) should be considered the first approach, but only in practice settings where is accuracy is sufficiently high. If high-quality USG is not available or fails to visualize the appendix, Abdominal Computed Tomography (CT) with lower-dose radiation protocols is often used [12].

4.4 Imaging Diagnosis

4.4.1 Abdominal Ultrasonography (USG)

The ultrasound in the diagnosis of AA was the first invented by Puylaert in 1986, one hundred years after the publication of the first paper on acute appendicitis by Fitz [13,14].

A normal appendix is not visualized by USG. When the presence of inflammation condition and dilated, it can be visualized. The features of appendicitis include hypertrophy of the appendiceal wall, disturbance of the normal layered structure, destruction of the wall, and purulent fluid or fecaliths within the appendiceal lumen. Appendicitis can be divided into three types depending on USG findings. The classification depended on the features of the high echo bands representing the submucosal layer, as well as the presence or absence of a visualized appendix and the length of the shorter diameter of the appendix (Table 2 and Fig. 1).

Table 1. Alvarado score [12]

<table>
<thead>
<tr>
<th>Component</th>
<th>Possible points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
</tr>
<tr>
<td>Migration of pain</td>
<td>1</td>
</tr>
<tr>
<td>to the right lower quadrant</td>
<td></td>
</tr>
<tr>
<td>Anorexia</td>
<td>1</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>1</td>
</tr>
<tr>
<td><strong>Signs</strong></td>
<td></td>
</tr>
<tr>
<td>Tenderness in the</td>
<td>2</td>
</tr>
<tr>
<td>right lower quadrant</td>
<td></td>
</tr>
<tr>
<td>Rebound pain</td>
<td>1</td>
</tr>
<tr>
<td>Elevated temperature</td>
<td>1</td>
</tr>
<tr>
<td><strong>Laboratory finding</strong></td>
<td></td>
</tr>
<tr>
<td>Leukocytosis</td>
<td>2</td>
</tr>
<tr>
<td>Left shift**</td>
<td>1</td>
</tr>
<tr>
<td>Total score</td>
<td>10</td>
</tr>
</tbody>
</table>

* Points are described to each symptom, sign, and laboratory finding; patients with a score of less 4 are unlikely to have appendicitis.

**A left shift is an increase in levels of immature neutrophil forms circulating in the peripheral blood.

Fig. 1. Ultrasonographic of appendicitis. (a) Catarrhal appendicitis, (b) Phlegmonous appendicitis, (c) Gangrenous appendicitis [15]
Table 2. Identification of acute appendicitis based on ultrasonographic findings [15]

<table>
<thead>
<tr>
<th>Type</th>
<th>Pathological diagnosis</th>
<th>The layer structure of the appendiceal wall</th>
<th>Submucosal layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>Catarrhal</td>
<td>Clear</td>
<td>No hypertrophy</td>
</tr>
<tr>
<td>Type II</td>
<td>Phlegmonous</td>
<td>Indistinct</td>
<td>Hypertrophied</td>
</tr>
<tr>
<td>Type III</td>
<td>Gangrenous</td>
<td>Disrupted</td>
<td>Indistinct and partly lost</td>
</tr>
</tbody>
</table>

A retrospective cohort study by Hanafi et al. reported that accuracy such as sensitivity and specificity was 96% and 100%. With the positive predictive value was 100%, and the negative predictive value was 82.35%, they conclusion diagnosis accuracy was 100% for under 15 age, and 94.6% for the above 15 years age in appendicitis case [16]. As described above, USG is an indispensable modality because it can be used to both diagnose appendicitis assess its severity.

4.4.2 Abdominal Computed Tomography (CT)

Many studies are focusing on the examination technique of CT and optimal reconstruction parameters for the diagnosis of AA. In adolescent and adult patients, CT has become the most widely accepted imaging strategy. In the USA, it is used in 86% of patients, with a sensitivity of 92.3% [17]. In one study of a randomized controlled trial comparing low dose versus standard dose of CT in 891 patients, the normal appendectomy rate was 3.5% for low dose CT versus 3.1% for standard-dose CT [18]. For older patients at increased risk of malignancy, preoperative CT recommended identifying malignancy masquerading as (or causing) appendicitis. Selective CT based on clinical risk score is likely to target its use and justify radiation exposure [19]. According to the American College of Radiology and American College of Surgeon, the recommendation that CT examination is not indicated for evaluation of suspected appendicitis in children until after USG be done [20].

6. MANAGEMENT OF ACUTE APPENDICITIS

Another study with meta-analysis of 9 randomized controlled trials found that the use of opioid groups did not significantly increase the risk of delayed or unnecessary surgery in 862 adults and children with acute appendicitis [22]. Nonsteroidal anti-inflammatory drugs and acetaminophen should also be considered for pain management in patients with suspected acute appendicitis, especially in those with contraindications to opioids. The previous study found that there was no difference between 107 patients with acute appendicitis to narcotics plus acetaminophen vs. placebo, and no change the Alvarado score also [23].

6.1 Non Surgical Management

Several European trials have demonstrated in the last 20 tears that in adults, conservative management of AA is feasible. Treating appendicitis with antibiotics alone is not a new concept. Since the inauguration of antibiotics therapy, it is feasible in trials as early as in the 1950s, or simply just out of need, e.g. in a maritime or military setting [24]. Gee D et al. stated that there were 252 passengers with suspected AA on ships in the sea who did not have the option of immediate surgery and thus were treated with antibiotics, which was successful in 84% of the patients. Also, in some forms of complicated appendicitis, antibiotics therapy are well established as initial treatment,
often in combination with drainage of large abscesses if needed [25]. Most treatment protocols include an initial course of intravenous antibiotics for 1-3 days, followed by oral antibiotics for 7 days. Usually, either a combination of a cephalosporin and tinidazole or broad-spectrum penicillin combined with beta-lactam inhibitor is being administered. In one trial, ertapenem has been used, leading to deserved criticism for inadequately using reserve antibiotics [26].

Salminen et al. found, there were no intra-abdominal abscesses or another major complication associated with delayed appendectomy in their patients randomized to antibiotic treatment [26]. Timing of antibiotics therapy is important since beginning treatment as early as possible has shown to increase success rates significantly [27]. If antibiotic treatment is not successful during the initial admission, rescue appendectomy must be performed. In recurrent disease, either a second course of antibiotics or appendectomy can be applied. Under both conditions, complications and risks of appendectomy are not elevated [26].

6.2 Surgical Managements

Sohn M et al. stated that there were four different techniques available for appendicitis surgeries, such as open appendectomy (OA), (conventional) laparoscopic appendectomy, single port laparoscopic appendectomy (LA) and NOTES-appendectomy with its different variations [28]. In another 5-year non-randomized study from Yau et al., consisted 1133 patients of which 244 had complicated appendicitis (among them, 175 underwent LA and 69 OA), LA patients had a shorter operative time (55 min vs 70 min), reduced length of stay (5 d vs 6 d) and a lower incidence of SSI (0.6% vs 10%) [29]. In the case of complicated appendicitis (gangrenous or perforated), the laparoscopic approach also reduced postoperative pain [30]. For the patient, the advantages of LA are reported to include faster recovery of muscle tone, low risk of postoperative adhesions, earlier return to normal daily activities, minimal scarring. On the other hand, conventional OA seldom causes scarring, can be ventral hernia, surgical site infection. In other words, the LA and OA procedures may only be different in patient's degree of difficulty. A study of the systematic review found that wound infection was less likely with LA compared OA (OR =0.43; 95% CI 1.19 to 2.93) [31].

7. COMPLICATIONS

The most concerning complication of AA perforation, it may lead to abscesses, peritonitis, bowel obstruction, fertility issues, and sepsis. It will happen among adults range from 17% to 32%, even with the increased use of imaging, and may lead to an increased length of hospital stay, extended antibiotic administration, and more severe postoperative complications. The risk factors that related to the patient for perforation event depends on older age, three or more comorbid conditions, and male sex. Time from symptom onset to diagnosis and surgery is directly associated with perforation risk [32,33]. Free perforation into the peritoneal cavity can lead to purulent or feculent peritonitis. A contained perforation can lead to appendix abscess phlegmon (inflammatory mass) [31].

8. CONCLUSION

The diagnosis and management of acute appendicitis in adults have been described with a focus on some current concept. For clinical manifestations with physical examinations and diagnosis finding on ultrasonography and CT are important to decide for management of antibiotic only or operative. For the management of acute appendicitis is still appendectomy as definitive therapy.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES


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Febyan; AJRRGA, 3(1): 1-7, 2020; Article no.AJRRGA.56863


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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/56863