

Bacterial Infections in Patients with Appendicitis in Hilla City, Iraq

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Abstract

Background: Appendicitis is an inflammation of the appendix, which along the tube of tissue extends from the large intestine. The study suggested that the appendix may have some role in gut immunity. **Objective:** The objective of this study was to investigate the bacterial infection in patients with appendicitis and study the distribution of appendicitis with sex and age groups in addition to clinical signs. **Materials and Methods:** The study was done on 78 patients ranged from 5 to 65 years (47 males and 31 females) who were attended to Hilla Teaching Hospital in Babylon province and diagnosed as acute appendicitis by surgeons; all specimens were sent to the bacteriology laboratory in Stuart's transport medium. The swab was cultured on different type of culture media to identification of bacteria. **Results:** From 78 samples, only 51 (65.3%) were positive to bacterial culture whereas 27 (34.6%) showed no growth of bacteria. The rate of infection was 33% in males and 18% in females. Results also found that *Escherichia coli* was predominant with 50.9% followed by *Streptococcus pneumoniae* (21.5%), *Pseudomonas aeruginosa* (13.7%), and *Klebsiella pneumoniae* (9.8%), while *Staphylococcus aureus* has shown a lowest isolation rate. Results revealed that 3.9% of clinical signs and symptoms of appendicitis were dominated right iliac fossa pain in 35.5% and fever in 26.9% of patients. **Conclusion:** From this study, we can conclude that there was a relation between bacterial infections and *E. coli* which was predominant and it was recorded that the infection in males was more than in females in patients with appendicitis.

Keywords: Appendicitis, bacterial infection, *Escherichia coli*, *Staphylococcus aureus*

INTRODUCTION

Appendicitis is an inflammation of the appendix, which along the tube of tissue extends from the large intestine. The study suggested that the appendix may have some role in gut immunity. Appendicitis is a medical emergency that almost requires prompt surgery to remove the appendix. Left untreated, an inflamed appendix will eventually burst or perforate, spilling infectious materials into the abdominal cavity.^[1] This can cause peritonitis, serious inflammation of the abdominal cavity's lining that can be fatal unless it is treated quickly with suitable antibiotics.

Appendicitis causes pain in the lower right abdomen. However, in most people, pain begins around the navel and then moves. As inflammation worsens, appendicitis pain typically increases and eventually becomes severe.^[2] Bacteria play important role in appendicitis, and the local application of antibiotics or antiseptics can reduce the incidence of wound infection. The bacterial growth in removed inflamed

appendices consists of a mix of aerobic and anaerobic bacteria, most often dominated by *Escherichia coli* and *Bacteroides* spp. A small novel study that used next-generation sequencing recorded a large number and greater variation of up to 15 bacterial phylae than expected in patients with acute appendicitis.^[3] Like other complex diseases, appendicitis may represent a convergence of host genetics and environmental exposures including diet and microbial colonization. Small studies have provided compelling evidence that bacterial community composition within the appendix differs between patients with and those without appendicitis.^[4] Several of these studies identified an association between appendicitis and the presence of fusobacteria in the appendix, building on prior studies of the appendicitis microbiome.

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The aim of this study was to investigate the bacterial infections in patients with appendicitis and study the distribution of appendicitis according to sex, age groups, and clinical signs.

MATERIALS AND METHODS

Study design and patients

This cross-sectional study included a total of 78 patients ranged from 5 to 65 years (47 male and 31 female) who attended Hilla Teaching Hospital in Babylon province and diagnosed as acute appendicitis by specialized surgeons. All patients were under follow-up laboratory investigation. General urine examination, white blood cells count, and C-reactive protein were done for all patients in addition to ultrasonography and computerized topography scanning. For ethical approval, verbal consent was taken from each patient before sampling.

Isolation and identification of bacterial isolates

Clinical specimens were taken during operation and sent to bacteriology laboratory in Stuart's transport medium. The swab was cultured onto blood agar, MacConkey agar, and 0.1% kanamycin blood agar. The blood agar plate and MacConkey agar plate were incubated aerobically while the kanamycin blood agar plate was incubated in an anaerobic jar. Metronidazole disc (5 units/disk) was placed on the kanamycin blood agar to facilitate recognition of anaerobic bacteria. The plates were examined after 24 h incubation at 37°C and again after a further 24-h incubation period. All isolated bacteria were identified using routine laboratory methods; then, Vitek 2 system was used to confirm identification of bacterial species.

Statistical analysis

The statistical calculations were performed using statistical package for the social sciences version 24 (SPSS, IBM Company, Chicago, USA), with Fisher's exact test to evaluate the differences between the study groups; differences were accepted at a level of significance of 0.05.

RESULTS

Results of this study found that out of 78 samples, only 51 samples (65.3%) were positive to bacterial culture whereas 27 (34.6%) showed no growth [Table 1].

Results found that different types of bacterial species isolates were recovered from patients with appendicitis. Furthermore, both Gram-negative and Gram-positive bacteria have been isolated from appendicitis cases [Table 2].

In this study, results found that *E. coli* was predominant with 50.9% followed by *Streptococcus pneumoniae* (21.5%), *Pseudomonas aeruginosa* (13.7%), and *Klebsiella pneumoniae* (9.8%) while *Staphylococcus aureus* has shown a lowest rate; it was only 3.9% [Table 2].

Table 3 shows that the rate of clinical signs and symptoms of appendicitis was dominated right iliac fossa pain in 35.5% of patients and fever in 26.9%, in addition to constipation, diarrhea, vomiting, and anorexia with low rates of occurrence.

Appendicitis was the marked distribution by age and sex. The rate of infection was higher in males (33%) than females (18%) [Table 4]. Results also revealed that in both males and females, the highest rates were observed in persons aged 11–20 years, compared with ages <10 years as shown in Table 5.

Table 1: Results of culture positive and culture negative from patients with appendicitis

Cultural results	n (%)
Positive	51 (65.3)
Negative	27 (34.6)
Total	78 (100)

Table 2: Types of bacterial isolates recovered from patients with appendicitis

Type of bacterial isolate	n (%)
<i>Escherichia coli</i>	26 (50.9)
<i>Streptococcus pneumoniae</i>	11 (21.5)
<i>Pseudomonas aeruginosa</i>	7 (13.7)
<i>Klebsiella pneumoniae</i>	5 (9.8)
<i>Staphylococcus aureus</i>	2 (3.9)
Total	51 (100)

Table 3: Distribution of clinical sign among patients with appendicitis

Clinical sign	n (%)
Right iliac fossa pain	28 (35.8)
Fever	21 (26.9)
Constipation	11 (14.1)
Diarrhea	9 (11.5)
Vomiting	5 (6.4)
Anorexia	4 (5.1)
Total	78 (100)

Table 4: Distribution of patients with appendicitis according to sex

Sex	Exam number	Positive (%)
Male	42	33
Female	36	18
Total	78	51

Table 5: Distribution of patients with appendicitis according to age groups

Age group (year)	Positive, n (%)
<10	4 (5.1)
11-20	29 (37.1)
21-30	19 (24.3)
31-40	13 (16.6)
41-50	6 (7.6)
51-60	7 (8.9)
Total	78 (100)

DISCUSSION

Acute appendicitis is one of the most frequent conditions that leads to emergency abdominal surgery. Appendicitis is due to closed-loop obstruction of the appendix which leads to bacterial overgrowth. The result of this study was in accordance with several authors who also reported isolation of different bacteria from patients with acute appendicitis in different provinces in Iraq.^[5-9] A study conducted in the same area of our study found that positive bacterial cultures were detected in 90 (81.8%) of patients while 20 (18.2%) of patients showed no bacterial growth. They also found that the aerobic bacteria accounted for 87 (78.4%) isolates whereas anaerobic was only 24 (21.6%) isolates. Gram-negative bacteria were presented in 96.4% while Gram-positive bacteria were accounted for 3.6%.^[10]

A variety of bacterial species have been reported to play a major role in appendicitis. Both, aerobic and anaerobic, Gram-negative and Gram-positive bacteria have been reported to be implicated in appendicitis such as *Bacteroides fragilis*, Beta-hemolytic streptococci, *Yersinia enterocolitica*, *E. coli*, and *Klebsiella* spp.^[3,11,12]

The results of this study also revealed that *E. coli* was the predominant pathogens among all bacterial isolates recovered from patients with acute appendicitis. This result was in agreement with previous study done by Naher and Ktab^[13] who found that *E. coli* was the predominant pathogen since it accounted for 36 (32.4%) of all isolates followed by *Bacteroides* spp. – 21 (18.9%), *K. pneumoniae* – 18 (16.2%), *P. aeruginosa* – 11 (9.9%), *Citrobacter freundii* – 7 (6.3%), *Salmonella typhi* – 5 (4.5%), *Proteus mirabilis* – 5 (4.5%), *Enterobacter aerogenes* – 4 (3.6%), *Peptostreptococcus* – 2 (1.8%), *S. aureus* – 1 (0.9%), and *Clostridium perfringens* – 1 (0.9%). They also found that mixed cultures were detected in 21 of cases.

The appendix is an extension of the cecum, which has a lower pH and higher fatty acid content than the gut and in consequence has been found to harbor bacteria different from those found in fecal samples. However, despite some variation, the profiles were not radically different, and the appendix does contain a high proportion of intestinal microbes.

The rate of clinical signs and symptoms of appendicitis was dominated right iliac fossa pain in 35.5% of patients and fever in 26.9%, in addition to constipation, diarrhea, vomiting, and anorexia with low rates of occurrence. This result was in agreement with the finding obtained by Bollinger *et al.*^[3]

Results of this study revealed that the infection rate of acute appendicitis was higher in males than females and the highest rates were observed in persons aged 11–20 years, compared with ages <10 years [Tables 4 and 5]. These results were

in accordance with several authors worldwide.^[6,14-16] The incidence of appendicitis was consistently higher in males than in females, even when persons with previous appendectomy were excluded from the denominator.^[7,17]

CONCLUSION

From this study, we found that there is a relation between bacterial infection with appendicitis and *E. coli* which was predominant in patients with appendicitis and it was recorded in males more than in females.

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Conflicts of interest

There are no conflicts of interest.

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