

# Appendicitis: Bacteriological Aspect And some other factors

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## Abstract:

This study aimed to show more definite bacteriological aspects of appendicitis in patients, direct and indirect bacteriological investigations were done for specimens from appendices resected from patients admitted Ramadi General Hospital, Al-Anbar Governorate, West Iraq.

Results showed that the age range of patients was (10-40) years, Male: female ratio was (2:1) among patients within age group (10-20) years. No significant difference ( $P > 0.05$ ) was found between enteric and anaerobic species, they were showing the isolation rates (43.7%) and (40.8%) respectively. *Escherichia. coli* took the first rank of isolation (21.1%) followed by *Bacteroides. fragilis* and, *Staphylococcus aureus* ( 12.6%) for each. **Proteus species** , **Peptococcus**, **Clostridium** and other bacterial types were showing lower isolation rates. All patients were showing high white blood cell counts, mean number was more  $10^4$  cell/cmm. C-reactive protein was increased also in sera of patients, more than 10 mg/L. We can conclude that bacterial infections particularly those constitute faecalith structure (normal colonic flora) play a role in appendicitis that is why antimicrobial choice for pre and postoperative therapy to reduce time as an important factor in constituting of complications. Both CRP and WBC are increased though they are non-specific diagnostic factors. Majority of patients were teenaged, males were showing higher rate of appendicitis in younger patients.

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**Keywords:** Bacterial appendicitis, Appendicitis, Appendix.

## Introduction:

The appendix is a long diverticulum that extends from the inferior tip of cecum and it is located in the lower portion of the abdomen<sup>(1)</sup>.

Appendicitis is an inflammation of the appendix, it is the most common acute surgical emergency of the abdomen<sup>(2, 3, 4)</sup>.

The cause of appendicitis relates to the blockage of the lumen of appendix, most commonly hard feces (fecalith) blocks the lumen, also bacterial and viral infections that leads to lymph node hyperplasia which squeeze the appendix and cause obstruction also. Traumatic injury to the abdomen may lead to appendicitis<sup>(2, 3, 5, 6)</sup>.

Genetic factor may be a predisposing factor for appendicitis, appendicitis may result from a genetic variant that predisposes Appendiceal obstruction<sup>(3, 7)</sup>. Parasites like nematodes, *Entamoeba histolytica* were blamed also to cause Appendicitis<sup>(8, 9, 10)</sup>. Different bacterial types were involved in appendicitis particularly those of fecal flora<sup>(11, 12)</sup>. In spite of many pointers in this category were mentioned that *E. coli*, *Bacteroides*, *Pseudomonas* species, *Fecal Streptococci* involved in appendicitis<sup>(11, 12, 13, 14, 15, 16)</sup>. In spite of the mentioned studies in this category, this study is devoted to show more definite bacteriological aspects of appendicitis, in our patients Whose appendices were resected.

## **Patients and Methods:**

### **Bacteriological specimens:**

Resected appendices were taken from patients admitted to the Surgical Wards of Ramadi General Hospital during the period from April – December 2007. Swabs were taken from the lumen of each appendix aseptically for bacteriological investigations following guidelines of WHO <sup>(1995) 17, 18</sup>.

Direct and indirect bacteriological investigations, were done for each specimen using Grams stain, Acid fast stain, as well as Cultivation aerobically on blood agar MacConkeys agar and Mannitol salt agar.

Anaerobic cultivation was done on media suitable for anaerobic cultivation like anaerobic blood agar with anaerobic gaspack jar. Biochemical tests were used to confirm bacteriological diagnosis, all bacteriological investigations were done following <sup>(18)</sup>.

### **Blood specimens:**

Blood was taken (5 ml) from each patient for hematological investigation, WBC, ESR, pooled sera from each patient were used for C-reactive protein estimation using CRP kit (Spain).

### **Results:**

It was found that the age of patients included in this study ranged from (10-40) years, this indicates that the majority of patients were young ( Table-1 ).

Male to female ratio was (2:1) within age group (10-20) years and the ratio (1: 1) was found among patients within age group (20-40) years (Table-1). No significant difference was found between enteric and anaerobic bacterial Isolation ( $P > 0.05$ ) (Table -2), they were showing the isolation rate (43.7 %) and (40.8%) respectively.

*E. coli* took the first rank of isolation (21.1%) followed by *B. fragilis* (12.6%) and *S. aureus* (12.6%). *Proteus* species, *Cl. perfringens* and *peptostreptococci* were showing the same rate of isolation (7.1%), while *Kelebsiella pneumoniae* and *S. faecalis* were isolated equally (5.6%). *Fusobacterium*, *Prevotella* and *Enterobacteria* were showing equal ratio of isolation (4.3%). *Salmonellae* were not isolated from any specimen of the study (Fig. 1).

All patients were showing increased white blood cell counts (WBC), mean count was above  $10^4$  cell/cmm (Table-4). Females within age group (21-40) years were showing higher WBC mean counts than that of females within age group (10-20) years ( $P < 0.05$ ).

Increased C- Reactive protein values were seen in sera of study patients, mean values were above (10 mg/L), but non significant difference was found between both sexes and two age groups ( $P > 0.05$ ) (Table-4).

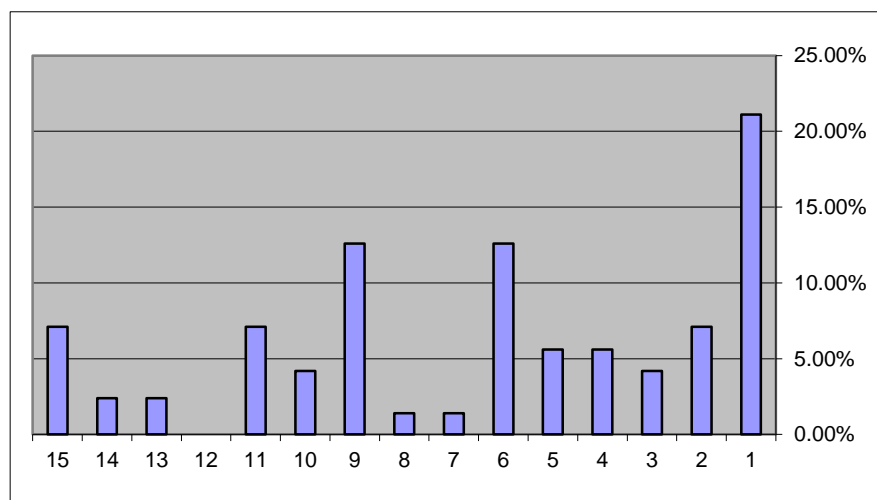
<i>Age group Year</i>	<i>Male</i>	<i>Female</i>	<i>M/F Ratio</i>	<i>Total</i>
10-20	15 68.1%	7 31.8%	2:1	22 36.7%
21-40	19 50%	19 50%	1:1	38 63.3%
<b>Total</b>	34 56.7%	26 43.3	----	60 100%

*Table-1: Age and sex distribution among patients with appendicitis*

<b>Bacterial group</b>	<b>Ratio of isolation</b>	
<b>Enteric bacteria</b>	31	4 3.7%
<b>Anaerobic bacteria</b>	29	40.8 %
<i>Staphylococcus species</i>	9	12.7%
<i>Pseudomonas aeruginosa</i>	1	1.4%
<i>Bacillus cereus</i>	1	1.4%
<b>Total</b>	71	100%

*Table-2 Ratio of isolated bacterial groups*

Fig. 1 Bacterial types regarding age and sex of patients



1	<i>E. coli</i>	6	<i>S. aureus</i>	11	<i>Cl. Perfringens</i>
2	<i>Proteus species</i>	7	<i>Psuedomonas aeruginosa</i>	12	<i>Fusobacterium species</i>
3	<i>Enterobacter Species</i>	8	<i>Bacillus. cereus</i>	13	<i>Lactobacillus species</i>
4	<i>Klebsiella pneumoniae</i>	9	<i>Bacteroides fragilis</i>	14	<i>Actinomyces species</i>
5	<i>S. faecalis</i>	10	<i>Prevotella species</i>	15	<i>Peptococcus species</i>

<i>Parameter</i>	<i>Age group (10-20) years</i>		<i>Age group (21-40) years</i>	
	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
<i>WBC N0: Cell/cmm</i>	9200-18800	900-19200	10000-19200	8800-22500
<i>Mean:</i>	12640	10485	10485	14420
<i>CRP Mean: mg/L</i>	11.0	10.0	12.0	12.5
<i>Range:</i>	26-24	6-24	6-24	6- 24

*Table-4 WBC, CRP values in sera of studied patients*

### Discussion:

Regarding the age of patients, included in this study ranges from 10 to 40 years was in accordance with the findings of <sup>(3, 5, 6)</sup> who mentioned that incidence of appendicitis gradually increases from birth, peaks in the late teen years and gradually declines in the geriatric years. The same male: female ratio was reported by <sup>(4, 9, 19, 20)</sup>, while this ratio among patients within age group (21-40) years disagrees with the findings of <sup>(21)</sup>.

The non significant difference between enteric and anaerobic bacteria isolation was due to the high count of each organism in colon, *Bacteroides* species count was  $10^9$  cell / gram of feces in colon and *E. coli* as an predominant enteric bacterium in colon was  $10^5$  cell/gram of feces <sup>(22, 23)</sup>.

High isolation rate of enteric bacteria represented by *E. coli* and anaerobic bacteria like *Bacteroides* was ought to their presence in colon as normal microbiota as they resist bile salt and reduced oxygen tension in this site <sup>(22, 23)</sup> as well as they constitute fecalith bulk of bacterial content which was the most common cause of luminal obstruction of appendix <sup>(3, 19)</sup>. The same truth was for other enteric and anaerobic bacteria were mentioned in this study.

Regarding *Staphylococcus aureus* isolation rate from these specimens was due to their suitability for colonic environment as heterofermentative organisms as well as its pathogenicity factors like protein A and toxins <sup>(22, 23)</sup>. Salmonellae were not isolated from any specimen of this study as colon is not suitable reservoir site for them, Salmonellae site of predilection are gall bladder and Peyer patches of small intestine <sup>(22, 23)</sup>. In addition to that patients of patients were not suffering from Salmonellosis.

This disagreed with that mentioned by Susanna et al (2004) <sup>(24)</sup> who isolated *Salmonella enterica*, serotype typhi from appendicitis case. Lactobacilli were considered as an important normal flora of appendix and colon, reduced number of *Lactobacillus* isolates was ought to the pathological changes in appendix and invasion of appendix by other pathogens which cause reduction of this organism number <sup>(3, 22, 25)</sup>. Majority of organisms in this category mentioned just names of bacteria involved in appendicitis.

Luigi Santacroce et al (2006) <sup>(11)</sup> mentioned that various bacteria like *Yersinia*, *Mycobacteria* were involved in appendicitis. Bolick (2006) <sup>(26)</sup> also emphasized the importance of optimizing volume status and initiating appropriate antibiotic should include coverage for common organisms like *E. coli* and *Bacteroides* as well as less common organisms like *Pseudomonas aeruginosa* and *S. faecalis*. Increased number of white blood cells (WBC) more than  $10^4$  cells /cmm was reported by other investigators <sup>(4, 11, 20, 27)</sup>. Though WBC mean count was considered as one of the parameters in different guidelines for the diagnosis of appendicitis like Alvarado Scoring System In 1986 <sup>(28)</sup>, it is still considered as nonspecific parameter in this field <sup>(29)</sup>.

Increased C- reactive protein values among patients of the study was also reported by <sup>(3, 11)</sup>. This increase was due to interleukin -6 release from liver due to inflammatory reaction<sup>(30)</sup>. In spite of commonly elevated CRP greater than 0.8 mg/dl in appendicitis <sup>(2, 3, 6)</sup> but still there is disagreement on sensitivity and specificity of this parameter in appendicitis <sup>(2, 27, 31)</sup>.

We can conclude that bacterial infections particularly those constitute fecalith structure (normal colonic bacterial flora) play a great role in the inflammatory process of appendicitis that is why antimicrobial choice for preoperative and postoperative therapy to reduce time as an important factor in constituting of complications and

accelerate surgical intervention to reduce pathogenic process. Both of WBC and CRP are increased in appendicitis though they are nonspecific parameters.

Majority of patients were teenaged individuals and males who were showing higher rate of appendicitis in younger teenaged patients.

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