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The bacteriological study of acute appendicitis

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Summary

The excised appendix from 500 cases of acute appendicitis in children aged from 13 days to 13 years was cultured under aerobic and anaerobic conditions. Among the 500 cases of acut appendicitis, 33 cases of peritonitis and 5 cases of appendiceal abscess were also studied.

In 235 of the cases both anaerobic and aerobic bacteria were isolated. Aerobic bacteria was isolated in 250 of the cases where anaerobic in 3. No growth was observed in 12 cases. Polymicrobial growth was found in 293 of the cultures.

The most commonly found anaerobes belonged to Bacteroides group (including B.fragilis, B.distasonis, B.ovatus, B.thetaitomicron, B. oralis, B melalinogenicus) and in decreasing order anaerobic cocci. Clostiridia, Fusabacterium, Propionibacterium, Eubacterium and Actinomyces species were isolated.

Among the isolates of aerobic bacteria, E.coli was the most frequent, followed in decreasing order by Klebsiella species, Pseudomonas species and aerobic cocci.

Bacteroides species, anaerobic cocci, E.coli and Klebsiella were predominant in peritonitis with appendiceal abscess.

Key words: *Appendix, abscess, flora, poymicrobial growth.*

Introduction

Bacterial flora of normal and inflamed appendices were investigated by many authors who attributed the infection to the most frequently isolated bacteria [4,19,21].

Five hundred cases of acute appendicitis, including 33 cases of peritonitis and 5 cases of appendiceal abscess were studied in order to isolate the aerobic, anaerobic or mixed flora of the inflamed appendix and find out their frequency and to study the isolated bacteria in the infection of the appendix.

The number of bacterial species per specimen was also studied and an attempt made to find out the differences in the frequency and the species of bacteria isolated from acute appendicitis, peritonitis and appendicial abscess.

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Material and Methods

Five hundred children on whom emergency appendicectomy was done in General Hospital of Alexandrupolis, Greece during sixteen months period and who had diagnosis of acute appendicitis, peritonitis and appendiceal abscess were included in the study. The excised appendix from these 500 histologically proven cases of acute appendicitis was divided under sterile conditions longitudinally. One half of the appendix was placed in amies transport medium and sent to the laboratory and the other half was sent for histologic examination. Aerobic and anaerobic cultures were performed according to routine techniques of the laboratory. Specimens were inoculated in blood agar, M Concey agar, neomycin blood agar and incubated aerobically and anaerobically (in anaerobic cabinet containing N_2 90 %, CO_2 5 %, H_2 5 %).

Identification of aerobes was done according to Cowan and Steel, and of the anaerobes with the Api system for anaerobes.

Results

In our study, only aerobes were isolated from the inflamed appendix in 250 of the cases, and only anaerobes in 3 cases. Both aerobes and anaerobes were

Table I. Aerobic, anaerobic and mixed flora in 500 patients with acute appendicitis, perintonitis and appendiceal abcsess.

Bacteria	Total	Number of bacterial isolates		
		Acute Append.	Perit.	Append. abscess
Aerobes	250	230	16	4
Anaerobes	3	3	-	-
Aerobes& anaerobes	235	217	17	1
No growth	12	12	-	-
Total	500	462	33	5

cultured in 235. In 12 cases no growth was observed. From the 33 cases of peritonitis only aerobic bacteria were isolated in 16 cases, while 4 isolated out of 5 cases of appendiceal abscess. Mixed flora, aerobic and anaerobic, were isolated from 17 cases of peritonitis and 1 cases of appendiceal abscess (Table I).

The number and species of bacterial isolates in the cases of acute appendicitis with aerobic or mixed growth are shown in Tables II and III. The anaerobes in acute appendicitis cases were Bacterioides oralis in two, and Bacteoides melaninogenicus in one.

Discussion

Anaerobes alone or together with aerobic bacteria were considered as the etiological agent in appendicitis by many authors who had recorded a percentage of isolation ranging from 30 % for the anaerobes and 27 % to 60 % for aerobes [1,5,7,9,11,14,17,21]. The commonest anaerobic bacteria isolated in acute appendicitis and in the complications of peritonitis, abdominal abscesses and wound infections were Bacteroides species, Clostridia and anacrobic cocci [9,10,15,20,21] and less often Fusobacterium, Propionibacterium, Eubacterium, Actinomyces species [2,3,6,18]. Polymicrobial growth from 1-8 bacterial species per specimen was mentioned by many authors [4,12,17].

In our study we observed growth of anaerobes in 3 cases, aerobes in 250 cases, anaerobes and aerobes in 235 cases and no growth in 12 cases of acute appendicitis. The most frequently isolated aerobic bacteria in the cases of acute appendicitis was E coli and in decreasing order of isolation Klebsiella, Pseudomonas, Proteus and aerobic cocci. Among the anaerobes, the Bacteroides group predominated and in decreasing order of isolation anaerobic cocci. Clostridia, Fusobacterium, Propionibacterium, Eubacterium and Actinomyces species.

Bacteroides fragilis, anaerobic cocci, E coli and Klebsiella were the most commonly isolated bacteria in the cases of peritonitis and appendiceal abscesses. Polymicrobial growth from 2 to 5 bacterial species per specimen was observed in 293 of our specimens.

Bacteroides alone or in combination with aerobic bacteria, were recorded as the etiological agent in cases of acute appendicitis, peritonitis and abdominal abscesses. The role of facultative anaerobes as E coli was not completely investigated but it was suggested that E coli alone or together with anaer-

Table II. Aerobic bacteria isolated from the appendix of 250 patients with aerobic growth.

BACTERIAL SPECIES	Number of bacterial isolates			
	Total	Acute Appendicitis	Peritonitis	Appendiceal abscess
E Coli	140	133	5	2
Klebsiella	29	23	4	2
Pseudomonas aeruginosa	18	14	4	-
Aerobic cocci	5	5	-	-
E coli & Klebsiella	18	15	2	1
E coli & Pseudomonas	20	19	1	-
E coli & Proteus	9	9	-	-
Klebsiella & Pseudomonas	5	5	-	-
Pseudomonas & Proteus	2	2	-	-
E coli & Proteus & Pseudomonas	4	4	-	-

Table III. Aerobic and anaerobic bacteria isolated from the appendix of 235 patients with mixed growth.

BACTERIAL SPECIES	Number of bacterial isolates			
	Total	Acute Appendicitis	Peritonitis	Appendiceal abscess
E Coli	117	107	9	1
Bacteroides sp.	116	106	9	1
Klebsiella	49	47	2	-
Anaerobic cocci	45	37	8	-
Pseudomonas	14	12	2	-
Clostridia	12	12	-	-
Fusobacterium	8	8	-	-
Propionibacterium	8	8	-	-
Eubacterium	6	6	-	-
Actinomyces sp.	5	5	-	-
E coli & Klebsiella	23	23	-	-
Bacteroides & anaerobic cocci	21	21	-	-
Bacteroides & Clostridia	9	-	-	-
E coli & Pseudomonas	16	14	2	-
E coli & Proteus	6	4	2	-
Bacteroides & Propionibacterium	3	3	-	-
Klebsiella & Pseudomonas	6	6	-	-
E coli & Proteus & Pseudomonas	4	4	-	-
Bacteroides & Eubacterium	2	2	-	-

obes can play an important role in the pathogenesis of appendicitis as it was shown in apendicitis as it was shown in experimental infections in rats [4,9,15]. It has been also noted that E coli can easily invade damaged tissue and produce secondary infections [13].

From our study we can suggest on the basis of culture results that for 235 of our cases both anaerobes and aerobes can be considered as the causative agent of the infection and for the 3 anaerobes only. As for the 250 of the cases with aerobic growth, E coli and the other aerobes listed in Table II could play a role in the pathogenesis of the infection. These aspects would be more readily confirmed if a serological investigation for specific antibodies in every case could be done.

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