THE BACTERIOLOGY OF PERFORATED APPENDIX

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SUMMARY

Perforated appendix is a serious surgical condition that carries a high morbidity. Antibiotic treatment is often started before the availability of bacteriological reports. The choice of antibiotics would depend on the bacteriology associated with perforated appendix. In a retrospective survey of the bacteriology of peritoneal pus obtained from cases of perforated appendix at the General Hospital, Kuala Lumpur, E. coli was found to be the most commonly encountered organism. This was followed in order of decreasing frequency by streptococci, Bacteroides species, Klebsiella-Enterobacter group and Pseudomonas aeruginosa. From the results of the antibiotic sensitivities an antibiotic regimen comprising of a combination of gentamicin, metronidazole and penicillin is recommended as appropriate chemotherapy in perforated appendix.

INTRODUCTION

Appendicectomy is the commonest intestinal operation performed in hospitals. While the mortality is low, morbidity is common and about 30% of patients develop wound infection. When perforation is present, the incidence of wound infection in the absence of appropriate chemotherapy may be as high as 60%. In addition there is also a high incidence of intra-abdominal sepsis. Post-operative sepsis after appendicectomy depends on several factors. Besides the presence or absence of perforation, factors like the age of the patient, delay in diagnosis, difficulty of the operation, the skill of the surgeon and the use of appropriate antibiotics may all influence the development of sepsis.

The success of chemotherapy depends on the sensitivity of the likely contaminating bacteria towards antibiotics. Very often it is necessary to start chemotherapy before the availability of bacterial culture and sensitivity reports. Unfortunately, there has been only a few studies on the bacteriology of appendicitis and these have all been done overseas.

The purpose of this survey is to determine the bacteriology associated with cases of perforated appendix in a Malaysian hospital. With the information obtained and from the analysis of the antibiotic susceptibility patterns we hope to be able to recommend an antibiotic regimen which would be suitable for the treatment of perforated appendix.

MATERIALS AND METHODS

A total of 83 patients was entered into this retrospective survey. These patients were admitted to the surgical unit of the Universiti Kebangsaan Malaysia, Faculty of Medicine, at the General Hospital, Kuala Lumpur during a one-year-period (January-December 1982). All patients were found to have perforated appendix during operation. Free pus was found in the peritoneal cavities of all

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patients. The volume of pus ranged from 5 ml to 100 ml. A pus swab was taken during operation and sent to the bacteriology laboratory in Stuart’s transport medium. The swab was cultured on to blood agar, MacConkey agar and 0.1 % kanamycin blood agar. The blood agar plate and the MacConkey agar plate were incubated aerobically while the kanamycin blood agar plate was incubated in an anaerobic jar.

A metronidazole disc (5 units) was placed on the kanamycin blood agar to facilitate recognition of anaerobic bacteria. The plates were examined after 24 hours incubation at 37°C and again after a further 24-hour incubation period. All bacteria isolated were identified using routine laboratory methods and antibiotic susceptibility testing was done by a comparative disc method.

RESULTS

The 83 patients comprised 61 males and 22 females with ages ranging from two years to 78 years. No bacteria was isolated from the specimens of 13 patients (16%). Of the 70 specimens which gave positive cultures, pure cultures were obtained from 38 while mixed cultures were obtained from the other 32. The culture results are summarised in Table I. E. coli was the most often isolated bacteria (isolated from 51% of the cases) followed by Streptococci (19%), Bacteroides species (18%), Klebsiella-Enterobacter group (18%) and Pseudomonas aeruginosa (12%).

<table>
<thead>
<tr>
<th>Organism</th>
<th>No growth</th>
<th>Pure culture</th>
<th>Mixed culture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td></td>
<td>17</td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td>Streptococci</td>
<td></td>
<td>4</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Bacteroides</td>
<td></td>
<td>1</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Klebsiella-Enterobacter</td>
<td></td>
<td>8</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td></td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Proteus</td>
<td></td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Staphylococcus</td>
<td></td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Citrobacter</td>
<td></td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Aeromonas</td>
<td></td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

In this survey Bacteroides species was isolated in only 18% of cases. The reason for this rather low rate of isolation is due probably to deficiencies in the collection and transport of specimens from the operating theatre to the laboratory. This is also reflected in the fairly high proportion of 'sterile' cultures. As pointed out by Leigh et al., Bacteroides species is rather difficult to isolate
TABLE II
ANTIBIOTIC SUSCEPTIBILITIES OF COMMONLY ISOLATED ORGANISMS IN 83 CASES OF PERFORATED APPENDIX

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Number</th>
<th>Percentage of isolates sensitive to antibiotic*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AMP</td>
<td>CAR</td>
</tr>
<tr>
<td>E. coli</td>
<td>42</td>
<td>57</td>
</tr>
<tr>
<td>Klebsiella- Enterobacter</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>9</td>
<td>89</td>
</tr>
<tr>
<td>Bacteroides species</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Streptococci</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

*AMP : Ampicillin  
CAR : Carbenicillin  
CEP : Cephaloridine  
CHL : Chloramphenicol  
COT : Cotrimoxazole  
ERY : Erythromycin  
GEN : Gentamicin  
KAN : Kanamycin  
PEN : Penicillin  
TET : Tetracycline  
MTZ : Metronidazole  
DAL : Clindamycin  
TOB : Tobramycin  
NET : Netilmicin  
AMI : Amikacin

unless special precautions are taken in the collection of the swab and its subsequent transport to the laboratory.

In their study, swabs were placed in Robertson's meat broth which is probably superior to Stuart's medium for the purpose of anaerobic culture. Furthermore, our laboratory does not operate a 24-hour service and considerable delay in receipt of specimens was experienced whenever the operation was performed after office hours or during weekends.

A high proportion of specimens yielded mixed cultures. This is not surprising as the offending pathogens are derived from the colonic flora. Because secondary peritonitis is often a mixed infection, antibiotic therapy therefore should be a broad spectrum and provide adequate aerobic as well as anaerobic cover.

In most instances antibiotics have to be started before bacterial culture and sensitivity results are available. From the results of this survey it appears that a combination of an aminoglycoside, an anti-anaerobic antibiotic and a penicillin would be required to provide adequate cover in cases of perforated appendix. An aminoglycoside like gentamicin is necessary because of its excellent activity against Enterobacteriaceae. The incidence of resistance to ampicillin is now too high to warrant its use in perforated appendix. A suitable anti-anaerobic antibiotic like metronidazole is required to cover for Bacteroides species. Metronidazole has been shown to effectively reduce the incidence of intra-abdominal sepsis after appendicectomy.

Clindamycin is another effective antibiotic against Bacteroides species but suffers from the serious gastrointestinal complication of pseudomembranous colitis. Chloramphenicol is shown in this study to be active against Bacteroides species as well as Enterobacteriaceae. It however lacks activity against Pseudomonas aeruginosa. Another drawback of chloramphenicol is its potential toxicity which may become a major problem when given in high doses as required for treatment of serious anaerobic infection.

We feel that penicillin should also be added to the treatment regimen because of the frequent isolation of Streptococci from the specimens.

We would, therefore, recommend an antibiotic regimen consisting of a combination of gentamicin metronidazole and penicillin for cases of perforated appendix. As pointed out by Emmerson, these antibiotics should be given before the operation together with the premedication and then continued for at least five days.

REFERENCES


