CLINICAL AND LABORATORY PROFILE OF INTRAABDOMINAL SEPSIS AMONG PEDIATRIC PATIENTS SEEN AT THE ADMITTING SECTION OF THE PHILIPPINE GENERAL HOSPITAL

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ABSTRACT

The clinical and bacteriologic data of 20 pediatric patients with intraabdominal sepsis were studied prospectively. There were 13 with generalized peritonitis and 7 with intraabdominal abscess. The most common cause for intraabdominal infection was secondary to ruptured appendicitis and its complications. The most frequent clinical manifestation associated with intraabdominal infection were vomiting, abdominal pain, and anorexia. Fever was present in all patients. Other frequent findings on physical examination were abdominal tenderness, hypoactive or absent bowel sounds, pararectal tenderness, and muscle guarding. The level of white blood cell count and abdominal x-ray findings did not correlate with severity of findings on operation or with the course of the patient. Twenty-eight isolates were recovered from the intraabdominal specimens, 22 aerobic and 6 anaerobic microorganisms. The commonly isolated pathogens were those considered as normal inhabitants of the gastrointestinal tract such as Escherichia coli and Bacteroides. Bacteremia was present in 4 patients, 3 of whom grew aerobic organisms and one grew an anaerobic organism from the blood culture. There were no cases wherein the same aerobic or anaerobic bacteria was isolated from both the intraabdominal specimens and blood culture. The results of this study are consistent with findings in other studies wherein both aerobic and anaerobic bacteria were isolated from patients with intraabdominal infection. Therefore, the rational antimicrobial choice would be a combination of agents effective against both pathogens.

Key words: intra-abdominal infection, sepsis, appendicitis, *E. coli*, *Bacteroides*

INTRODUCTION

Intraabdominal infections are serious clinical problems that are often difficult to diagnose and treat properly, especially in the young child. Children with intraabdominal infections usually present with nonspecific signs and symptoms resulting in delay in diagnosis and treatment. These infections commonly result from contamination of the peritoneal cavity or its surrounding structures by intestinal contents [1]. In children, this usually leads to generalized peritonitis or when localized, intraabdominal abscess formation. Specific causes include ruptured appendicitis, closed loop obstruction, and perforated bowel [2].

Both aerobic and anaerobic bacteria have been found to be responsible for the morbidity and mortality associated with intraabdominal sepsis. Few studies undertaken in developing countries, however, have included anaerobic studies due to difficulties in the collection, transport, and processing of specimens. In addition, information with regards the role of anaerobes in childhood infection is scant.

This prospective study aims to define the clinical spectrum of intraabdominal infection in pediatric patients, the common causes of intraabdominal infections, its etiologic agents including anaerobic pathogens and their antimicrobial susceptibility pattern. The frequency of bacteremia associated with intraabdominal infection and the commonly isolated organisms causing the bacteremia will also be determined.

MATERIALS AND METHODS

Pediatric patients aged 0-14 years, diagnosed to have intraabdominal sepsis secondary to generalized peritonitis or intraabdominal abscess and who underwent surgery were included. Patients with primary or spontaneous peritonitis, those who received antibiotics longer than 48 hours prior to enrollment into the study, and those diagnosed to have nosocomial infection were included. Due to the difficulties involved in the collection and processing of specimens for anaerobic cultures, only those screened and enrolled by two of the investigators prior to surgery were included.

Upon admission to the study, pertinent clinical history was taken and complete physical examination was performed on all patients. Laboratory workup included white blood cell count with different count, platelet count and radiographic examination of the abdomen. If indicated, other special examinations such as abdominal ultrasound or barium enema were also requested.

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Bacteriologic studies included aerobic and anaerobic cultures of the blood and intraabdominal specimens. Blood was extracted from different sites and inoculated into two brain heart infusions for aerobic culture and two anaerobic media broths for anaerobic cultures. Specimens from peritoneal fluid or intraabdominal abscess were collected intraoperatively. These intraabdominal specimens were aspirated using sterile needle and syringe and any air bubble expelled before capping with a rubber stopper. The syringe was then used as a transport container and brought immediately to the laboratory where the specimens were plated directly on anaerobic culture media within ten minutes after collection. The remaining specimen was submitted for aerobic culture. All specimens for aerobic culture were submitted to the microbiology laboratory of the Philippine General Hospital where standard techniques were used for isolation, identification, and antibiotic susceptibility testing. Culture media bottles and plates containing the inoculated specimens for anaerobic studies were placed in special gas-impermeable transparent plastic bags containing an absorber, catalase, and indicator tablet and resealed using special plastic sealers or heat sealed. These were then immediately incubated at 35°C then brought to the Research Institute for Tropical Medicine not later than 48 hours after incubation. Blood culture bottles and incubated plates were inspected daily for evidence of growth and subcultured into appropriate selective anaerobic media. Identification of anaerobic bacteria was based on gram stain characteristics, colonial morphology, growth on selective media and reactions in biochemical tests. Susceptibility of anaerobes to selected antimicrobials were performed by using the broth disk sensitivity method.

RESULTS

From May 1989 until June 1991, twenty patients were included in the study. There were twelve males and eight females. Age ranged from 3 days to 150 months (average 83 months). Fifty percent of the cases belonged to the 5-10 year age group. There were 13 cases of generalized peritonitis and 7 cases of intraabdominal abscess. The underlying cause for generalized peritonitis were identified as ruptured appendicitis (8), perforated typhoid ileitis (2), ascending cholangitis secondary to infected choledochal cyst (1), meconium peritonitis (1), and ruptured polycystic kidney (1) [Table 1]. The 7 cases of intraabdominal abscess were all related to ruptured appendicitis. There were no cases of visceral or retroperitoneal abscesses in the study. The right lower quadrant was the site of abscess in majority of the cases and presented as periappendiceal abscess. Two patients had multiple intraperitoneal abscesses: one patient had pus located in both the right lower quadrant and the pelvic space while in the other patient, pus was located in the right lower quadrant, the subhepatic, and subphrenic spaces [Table 2].

Table 1 *Etiology of intraabdominal infection in twenty pediatric patients.*

ETIOLOGY	GENERALIZED PERITONITIS (%) N=13	INTRAABDOMINAL ABSCESS (%) N=7	TOTAL NO. (%) N=20
Ruptured appendicitis	8(61)	7(100)	15(75)
Perforated typhoid ileitis	2(15)	0	2(10)
Infected choledochal cyst	1(8)	0	1(5)
Meconium peritonitis	1(8)	0	1(5)
Ruptured polycystic kidney	1(8)	0	1(5)

Table 2 *Location and type of intraabdominal abscess.*

LOCATION	NO. OF CASES (%)
Right lower quadrant	6(86)
Pelvic	2(28)
Subhepatic	1(14)
Subphrenic	1(14)

** Patients may have abscess in more than one location.*

CLINICAL MANIFESTATIONS

Abdominal pain occurred in 18 patients. Another common symptom was vomiting which occurred in all cases of generalized peritonitis and 86 percent of cases with intraabdominal abscess. Other clinical symptoms are shown on Table 3.

All patients were noted to be febrile with 75 percent of patients having temperature in the range of 38.0°C to 38.9°C. Generalized abdominal tenderness and hypoactive or absent bowel sounds were the most common findings.

Table 3 *Clinical manifestations of intraabdominal infections in 20 pediatric patients.*

CLINICAL FEATURE	GENERALIZED PERITONITIS (%) N=13	INTRAABDOMINAL ABSCESS (%) N=7	TOTAL NO. (%) N=20
SIGNS			
Abdominal pain	11(85)	7(100)	18(90)
Vomiting	13(100)	6(86)	19(95)
Anorexia	6(46)	4(57)	10(50)
Constipation	4(31)	4(57)	8(40)
Diarrhea	0	1(14)	1(5)
SYMPTOMS			
Rise in temperature			
37.5-37.9°C	1(8)	1(14)	2(10)
38.0-38.9°C	9(69)	6(86)	15(75)
39.0-40.0°C	3(23)	0	3(15)
Abdominal tenderness			
Localized	2(15)	3(43)	5(25)
Generalized	10(77)	4(57)	14(70)
Abdominal distention	6(46)	0	6(30)
Abn. bowel sounds			
Hypoactive	7(54)	4(57)	11(55)
Hyperactive	1(8)	0	1(5)
Absent	4(31)	1(14)	5(25)
Muscle guarding	8(61)	2(28)	10(50)
Pararectal tenderness	9(69)	5(71)	14(70)

LABORATORY FINDINGS

The white blood cell count was more than 10 x 10^9 in 30.8 percent of patients with peritonitis and in 57.1 percent in patients with abscess. The average white blood cell count for patients with abscess was higher than in patients with peritonitis (17.8 x 109 versus 9.2 x 10^9). White blood cell count was more than 20 x 10^9 in four patients with intraabdominal abscess whereas the highest white cell count in patients with generalized peritonitis was 18.4 x 10^9. There were only 3 cases with white blood cell count less than 5 x 10^9 and all occurred in patients with generalized peritonitis. In 14 cases where platelet count was determined, platelet count was above 150,000 in all cases. Abdominal x-ray in patients with generalized peritonitis showed 3 cases of pneumoperitoneum, 3 cases of gut obstruction, and 1 case each with ascites and ileus. There were 3 cases with no localizing signs on plain abdominal film. No x-ray was done in 2 patients. Among the patients with intraabdominal abscess, 2 patients showed gut obstruction and another 2 patients showed ileus on abdominal films. One patient had normal findings. Two patients had no x-rays taken.

Table 4 *Laboratory findings in 20 pediatric patients with intraabdominal infections.*

LABORATORY FEATURES	GENERALIZED PERITONITIS (%) N=13	INTRAABDOMINAL ABSCESS (%)	TOTAL NO. (%) N=20 N=7
Leukocyte count			
<5000/mm3	3(23)	0	3(15)
5000-10,000/mm3	6(46)	3(43)	9(45)
10,0001-15,000/mm3	2(15)	0	2(10)
>15,000/mm3	2(15)	4(57)	6(30)
Platelet count*			
<150,000	0	0	0
150,000-200,000	2(22)	1(20)	3(21)
200,000-400,000	7(78)	4(80)	11(79)
Abdominal x-ray**			
Gut obstruction	3(27)	2(40)	5(31)
Ileus	1(9)	2(40)	3(19)
Pneumoperitoneum	3(27)	0	3(19)
Ascites	1(9)	0	1(6)
No localizing signs	3(27)	1(20)	4(25)

* *Denominator was limited to patients with platelet count determination.*
** *Denominator was limited to patients with abdominal x-ray taken.*

BACTERIOLOGIC DATA

Intraabdominal specimens were submitted for aerobic studies in only 19 patients since the peritoneal fluid specimen from one case was not received in the microbiology laboratory. However, intraabdominal specimens from all 20 patients were submitted for anaerobic studies. There were 28 isolates from the intraabdominal specimens. Twenty-two were aerobic bacteria isolated from 19 patients and 6 were anaerobic bacteria isolated from 20 patients. Twelve patients had a single isolate while 7 had 2 or more isolates [Table 5].

Table 5 *Number of isolates recovered from the peritoneal cavity of 20 pediatric patients with intraabdominal infection.*

	GENERALIZED PERITONITIS N=13	INTRAABDOMINAL ABSCESS N=7	TOTAL NO. N=20
TOTAL ISOLATES			
Aerobic	14	8	22
Anaerobic	3	3	6
ISOLATE PER PATIENT			
Aerobic*	1.17	1.14	1.16
Anaerobic	0.23	0.43	0.30
SINGLE ISOLATE	8	4	12
POLYMICROBIAL ISOLATES			
2 isolates	3	2	5
3 isolates	1	1	2

* *Computed only for 19 patients (12 with generalized peritonitis and 7 with intraabdominal abscess).*

The isolates recovered from the peritoneal cavity are presented in Table 6. Among the aerobic bacteria, *Escherichia coli* was the most common isolate. There were 6 anaerobic bacteria isolated from the intraabdominal specimens of 5 patients. Two out of the 5 patients had generalized peritonitis secondary to ruptured appendicitis, 2 patients had periappendiceal abscess, and 1 patient had perforated typhoid ileitis. All the isolates belonged to the Bacteroides species: *Bacteroides* pigmented organism (3), *Bacteroides vulgatus* (2), and *Bacteroides asaccharolyticus* (1). One patient with periappendiceal abscess grew both *Bacteroides vulgatus* and *Bacteroides* pigmented organism from the same intraabdominal specimen.

Table 6 *Isolates recovered from the peritoneal cavity of pediatric patients with intraabdominal infection.*

ISOLATE	TOTAL NO. (%) N=28 Isolates
AEROBIC BACTERIA	
E. coli	13(46)
Klebsiella	4(14)
Proteus mirabilis	2(7)
Enterococcus	1(3)
Achromobacter	1(3)
Streptococcus	1(3)
ANAEROBIC BACTERIA	
Bacteroides (pigmented)	3(10)
Bacteroides vulgatus	2(7)
Bacteroides asaccharolyticus	1(3)

Table 7 *Isolates recovered from blood cultures of bacteremic pediatric patients with intraabdominal infection.*

ISOLATE	TOTAL NO. (%) N=5 Isolates
AEROBIC BACTERIA	
Enterococcus	1(20)
Salmonella Grp. D	1(20)
B-hemolytic Streptococcus	1(20)
Staphylococcus epidermidis	1(20)
ANAEROBIC BACTERIA	
Bacteroides fragilis	1(20)
Propionebacterium	1(20)

Blood culture was positive in 5 patients [Table 7]. The aerobic organisms isolated were *Enterococcus* in a patient with periappendiceal abscess and *Salmonella* group D in a patient with perforated typhoid ileitis. A patient with ruptured polycystic kidney grew both *Staphylococcus epidermidis* and Beta hemolytic *Streptococcus* after 24 hours in two blood cultures. Anaerobic bacteria was cultured from 2 blood cultures. However only 1 isolate was considered a true pathogen. The isolate was *Bacteroides fragilis* which was cultured from the blood of a patient with generalized peritonitis secondary to ruptured appendicitis. The other isolate was *Propionebacterium* species, a common inhabitant of the skin. This was considered to be merely a contaminant as there were no underlying clinical conditions nor cardiovascular or neurologic shunts which could account for the presence of this bacteria in the blood. There were no cases wherein the same aerobic or anaerobic bacteria was isolated from both the intraabdominal specimens and blood cultures.

Susceptibility testing performed on isolates of *Escherichia coli, Klebsiella, Proteus mirabilis,* and *Achromobacter* showed that all isolates were sensitive to the aminoglycoside tested (gentamicin, netilmycin, tobramycin, or amikacin). Among the isolates tested against ampicillin, resistance was observed in 6 out of 11 *E. coli* isolates and in 1 out of 2 *Klebsiella* isolates although 2 *Proteus mirabilis* isolates and the single isolate of *Achromobacter* were sensitive. Four isolates of *E. coli* and 2 out of 3 isolates of *Klebsiella* tested against amoxycillin-clavulanic acid were sensitive. Among the isolates tested against cefalexiin, 1 out of 4 isolates of *E. coli* and 1 isolate of *Proteus mirabilis* were resistant. All isolates of *E. coli, Klebsiella, Proteus mirabilis* and *Achromobacter* were sensitive to cefuroxime and ceftriaxone.

Among the gram positive organisms isolated, sensitivity testing was performed only on the isolate of *Enterococcus*. This was noted to be sensitive to penicillin, ampicillin, erythromycin, vancomycin, tetracycline, and to the quinolones in general. No sensitivity testing was performed on the isolate of *Streptococcus* (nonenterococcal) which grew on 1 intraabdominal specimen concommitantly with *E. coli*.

In patients with positive aerobic blood culture, the isolate of *Enterococcus* was found to be highly sensitive to ampicillin and the quinolones and had intermediate sensitivity to penicillin. The isolate of *Salmonella* group D in 1 patient with typhoid ileitis was sensitive to ampicillin, chloramphenicol, and cotrimoxazole. In the patient from whom *Staphylococcal epidermidis* and Beta hemolytic *Streptococcus* group A were isolated from 2 out of 2 blood cultures, susceptibility studies were only done on the isolates of *Staphylococcus*. This showed sensitivity to oxacillin, nafcillin, erythromycin, cefalexin, cotrimoxazole, and clindamycin.

Among the anaerobic bacteria isolated from intraabdominal specimens, the 2 isolates of *Bacteroides vulgatus* tested were sensitive to chloramphenicol and clindamycin and were resistant to penicillin, piperacillin, piperacillin, cephalothin, and cefotaxime. No susceptibility studies could be done on the 4 isolates of pigmented *Bacteroides* species due to technical difficulties in performing the test on these microorganisms. The isolate of *Bacteroides fragilis* which grew in 1 blood culture was also sensitive to chloramphenicol and clindamycin and resistant to penicillin, piperacillin cephalothin, and cefotaxime. No susceptibility testing was done on the isolate of *Propionebacterium sp.* since this was considered as a contaminant. Due to unavailability of metronidazole sensitivity discs, the isolates from the intraabdominal specimens and blood could not be tested against this antibiotic.

TREATMENT

In the 15 patients suspected to have intraabdominal infection secondary to ruptured appendicitis, 11 were started on metronidazole plus either netilmycin or gentamicin, 2 were started on metronidazole plus ampicillin and an aminoglycoside, 1 was started on metronidazole plus cefazolin and netilmycin, and 1 was given metronidazole alone. Among the 2 cases of ruptured typhoid ileitis, 1 was given chloramphenicol plus gentamicin while the other was given ampicillin plus metronidazole and netilmycin. The case with upper gut obstruction which turned out to be a ruptured polycystic kidney was started on ampicillin plus metronidazole and gentamicin. The case suspected to have ruptured viscus which turned out to be meconium peritonitis with gastric perforation was started empirically on ampicillin plus metronidazole and netilmycin. The case of ascending cholangitis initially diagnosed to have pyogenic liver abscess to rule out amoebic liver abscess was started preoperatively on cefazolin plus metronidazole and gentamicin.

All these patients underwent exploratory laparotomy and peritoneal lavage. Definitive surgical procedure depended on the underlying pathology for the intraabdominal infection.

In all of these patients, antimicrobials were ordered preoperatively but were not started in 5 patients due to financial reasons. Antimicrobials were given for 1 to 3 doses prior to surgery in the other patients. Except for 1 patient where metronidazole was given by suppository, all the other patients were given antimicrobials intravenously. Postoperatively, the total number of days when antimicrobials were given intravenously varied from 1 to 10 days. Once the medications were

shifted to oral preparation, the choice of antimicrobials as well as total duration of therapy also varied, with a range of 2 to 6 days.

OUTCOME

There were 16 patients who were discharged improved. Duration of hospital stay ranged from 3 to 10 days (average 6.3 days). There were 3 mortalities and 1 patient who went home against medical advise, all of whom presented with generalized peritonitis. The etiologies identified for the three mortalities were ruptured polycystic kidney, ruptured appendicitis and perforated stomach with meconium peritonitis. Peritoneal fluid cultures grew *Enterococcus* in the patient with polycystic kidney and *E. coli* in the patient with perforated appendicitis. Unfortunately, the peritoneal fluid specimen from the patient with gastric perforation was not received at the laboratory. Blood culture was positive only in the patient with polycystic kidney and this grew *Staphylococcus epidermidis* and *B-hemolytic Streptococcus* in 2 out of 2 blood cultures. There were no anaerobes cultured from the specimens of any of these patients. Despite appropriate antibiotics and surgery, there was rapid deterioration in the patients' condition and they eventually expired.

The case who went home against medical advice was admitted with an impression of hepatic abscess but intraoperatively was found to have bile peritonitis with infected choledochal cyst. Impression was changed to ascending cholangitis secondary to an infected choledochal cyst. Both the peritoneal fluid and blood cultures grew *E. coli*. The patient developed deepening jaundice and manifestations of hepatic encephalopathy on the tenth postoperative day. Her conditioned progressively worsened until the relatives brought the patient home against medical advise on the twenty-sixth hospital day.

DISCUSSION

The most common type of intraabdominal sepsis reported is generalized peritonitis usually following penetrating or blunt abdominal trauma or organ perforation. In this study, generalized peritonitis occurred in 13 out of 20 patients, all resulting from organ perforation. There were no cases of peritonitis resulting from abdominal trauma included due to the set-up at the emergency room complex where all trauma cases, whether adult or pediatric cases are seen directly at the trauma section and do not pass the pediatric admitting section. In this study, appendicitis with perforation was the most common disease that preceded generalized peritonitis. This finding is consistent with the study of Altemeier where appendicitis was found to be responsible for approximately 20 percent of the 500 cases of intraabdominal sepsis encountered during a 10-year period [3]. The other causes of generalized peritonitis in this study were perforated typhoid ileitis (2), ascending cholangitis (1), meconium peritonitis (1), and ruptured polycystic kidney (1).

Localization of intraabdominal infection is less commonly observed in children than adults due to a lower general resistance and a relatively smaller omentum. Localization results in intraperitoneal, retroperitoneal, or visceral abscess formation. There were seven cases of intraabdominal abscess, all associated with ruptured appendicitis. There were no cases of retroperitoneal or visceral abscesses possibly due to the small sample size.

The most frequent clinical manifestation associated with intraabdominal infection, both in generalized peritonitis and intraabdominal abscess, were vomiting, abdominal pain, and anorexia. Fever was present in all patients with 75 percent of patients having temperatures in the range of 38.0°C to 38.9°C. Other frequent findings on physical examination were abdominal tenderness, hypoactive or absent bowel sounds, pararectal tenderness, and muscle guarding.

Laboratory examinations were nonspecific, emphasizing the need to correlate results of laboratory work-up with the clinical findings. The level of white blood cell count did not correlate with severity of findings on operation or with the course of the patient. In 16 patients who had abdominal x-rays taken, findings were also nonspecific and did not correlate with the severity of the condition. One patient who died of septic shock secondary to generalized peritonitis showed no localizing signs on plain abdominal film and only ascites on upright film. Therefore, the x-ray findings should not be used as the sole basis for predicting the clinical course or need for surgical intervention but should be correlated with clinical findings.

The polymicrobial nature of pathogens in patients with intraabdominal infection following gastrointestinal contamination is evident from several reports. Swenson and co-workers demonstrated an average of 1.4 aerobes and 2.4 anaerobes per infection in 64 patients [4]. Stone and associates in their series of 512 patients isolated an average of 1.89 aerobic and 2.4 anaerobic species per infection [5]. Similar findings have been observed in pediatric patients. In their study on children, Dunkle and co-workers were able to recover an average of 0.8 aerobic and 2.5 anaerobic organisms from the peritoneal fluid of 22 patients with appendicitis or perforated viscus [6]. In these studies, anaerobic bacteria have been isolated from 31 to 96 percent of cases with intraabdominal infection.

In the present study, 28 isolates were recovered from the intraabdominal specimens of 19 patients. There were 22 aerobic microorganisms and 6 anaerobic microorganisms. There were 12 patients with a single isolate and 7 with two or more isolates. Among the aerobic isolates, *Escherichia coli* was the most commonly isolated (13). Other gram negative enteric microorganisms isolated were *Klebsiella* (4), *Proteus mirabilis* (2), *Enterococcus (1)* and *Achromobacter* (1). Anaerobes were isolated from the intraabdominal specimens of only 5 patients. All of the isolates were *Bacteroides* species.

In 13 cases, intraabdominal sepsis was due to aerobic organisms alone. Both aerobes and anaerobes were involved in 6 cases of intraabdominal infections, 5 of whom grew aerobic and anaerobic organisms from the intraabdominal specimens and 1 grew an aerobic organism from the intraabdominal specimen and an anaerobic organism from the blood. The frequency of anaerobic isolates in this series is lower than noted in other series. The possible reasons for this are presented. Although the specimens were inoculated immediately into anaerobic media after aspiration by the surgeons, whether specimens were collected as soon as possible after the peritoneum was opened could not be ascertained. In the study by Stone and associates, almost every specimen of peritoneal fluid from 159 patients with perforated appendicitis or traumatic injury to the colon was positive for anaerobes if taken immediately upon surgical entry to the abdomen. However, after 1 to 2 hours of operative time, they were able to isolate the same anaerobic microorganism from only 10 percent of the patients [5]. Another factor could be the method of anaerobic culture itself. All of the studies on anaerobic bacteriology reviewed used the conventional anaerobic jar system for anaerobic culture studies. There were no studies encountered comparing the frequency of isolation using the gas-impermeable plastic bag with the anaerobic jar system.

Bacteremia has been reported in patients with intraabdominal infection. In the study by Stone, bacteremia occurred in only 4.1% of patients with intraabdominal infections. Blood cultures yielded 69 different bacterial isolates of which 30% were anaerobic species [5]. Swenson reported positive blood cultures in 28% of patients [4]. In this study, there were 4 bacteremic cases (20%), 3 of whom grew aerobic organisms and 1 grew an anaerobic organism. In the 3 patients with aerobes growth from the blood, a total of 4 aerobic organisms were isolated. Among the aerobic isolates were *Enterococcus* from a patient with periappendiceal abscess and *Salmonella* Group D from a patient with ruptured typhoid ileitis. One patient with ruptured polycystic kidney grew both Beta hemolytic *Streptococcus* Group A and *Staphylococcus epidermidis* after 24 hours in 2 blood cultures. Anaerobic organisms were recovered from only 2 patients. However, only the isolate of *Bacteroides fragilis* was considered significant. This study supports the finding of other authors that anaerobic organisms have been rarely isolated from blood cultures of pediatric patients. In the study by Dunkle and coworkers, anaerobic blood culture was positive in only 1 out of 22 patients with peritonitis and in general only 0.3% of blood cultures contained anaerobic organisms which were involved in the pathogenesis of the patient's disease. *Bacteroides*, a part of the endogenous gastrointestinal flora was the most commonly isolated anaerobic organism. This is consistent with other studies on anaerobic bacteremia in children [7].

Prompt diagnosis and surgical intervention are essential to the successful management of intraabdominal sepsis. Parenterally administered antibiotics are used to decrease the incidence of septicemia and to prevent the local invasion of normal tissue by the invading bacteria. Selection of appropriate antimicrobial agents should be made on the basis of knowledge of the infecting pathogens and their antimicrobial susceptibility. However, the initial antibiotic regimen is usually chosen on clinical grounds before the infecting organism has been identified microbiologically and results of sensitivity tests are available. This study confirms the observation in other studies that the organisms isolated from the infected sites were usually the aerobic and anaerobic pathogens that normally reside in the gastrointestinal tract. The most common aerobic pathogen was *E. coli* and among the anaerobic pathogens, all belonged to the *Bacteroides* species. The debate continues concerning the optimal antibiotic regimen for treatment of intraabdominal sepsis. Most clinical studies of intraabdominal infections have stressed the use of aminoglycosides for the aerobic enteric gram-negative bacilli and of clindamycin, chloramphenicol, or metronidazole for the anaerobic organisms. There have also been studies regarding the use of the third generation cephalosporins or even imipenem-cilastatin in patients with intraabdominal infections but no definite recommendations have been given. In this study, majority of the patients were started on metronidazole plus an aminoglycoside. Others were started on triple antimicrobial therapy consisting of cefazolin or ampicillin plus metronidazole and an aminoglycoside. There was only one patient given single drug of metronidazole. As seen from the susceptibility tests on the aerobic isolates, all isolates in general were sensitive to the aminoglycosides tested. Sensitivity pattern to ampicillin and the first generation cephalosporins varied. All anaerobic isolates tested were sensitive to chloramphenicol and clindamycin. No

sensitivity test for metronidazole could be performed due to unavailability of the disc. Susceptibility testing of the pigmented Bacteroides isolates could not be done because of technical problems and confirms the difficulties in performing culture and susceptibility studies on anaerobic organisms. Nevertheless, since all patients with anaerobes isolated from either blood or intraabdominal specimens were given metronidazole with apparent response and no mortalities in this group, it may be presumed that all the anaerobic isolates were sensitive to metronidazole.

LIMITATIONS

This preliminary study is limited primarily by the small sample size. Difficulty in enrolling patients was due to the unpredictability of admission of patients with intraabdominal infections requiring surgery. Most patients would arrive after office hours. Also, patients with prior intake of antibiotics for more than 48 hours and patients who have stayed longer than 72 hours in the hospital were excluded from the study. Due to the small sample size, no definite conclusions can be made regarding the data collected.

There were a lot of technical difficulties encountered with regard to the collection, transport, and processing of specimens for anaerobic studies. Although the surgeons were instructed to collect the specimens as soon as possible after opening the peritoneum, the exact time interval between opening the peritoneum and aspiration of the specimens could not be ascertained. Ideally, anaerobic transport media should be used. However, due to considerations of cost, a compromise was made and the stoppered syringe was used as the transport container just making sure that the specimens were brought to the laboratory as soon as possible after collection. Processing of specimens was done by two of the investigators, both of whom were instructed on proper plating techniques. Nevertheless, none of the two investigators were medical technicians and whether this may be considered as a factor affecting yield of anaerobes has to be determined. Isolation, identification, and susceptibility testing were subsequently done by one medical technician trained in anaerobic microbiology.

Susceptibility test on aerobic isolates were done using the standard disc diffusion technique. However, further sensitivity studies were not done to verify the resistant isolates. For the anaerobic isolates, due to the difficulties encountered as mentioned in the previous sections, susceptibility testing could not be done on all isolates and for all requested antimicrobial agents.

SUMMARY AND RECOMMENDATIONS:

The clinical features and bacteriologic data of 20 pediatric patients with intraabdominal infection from various causes were studied prospectively. The clinical manifestations and laboratory aids are not conclusive in establishing the cause of the intraabdominal infection or for determining the severity of the underlying pathology.

There were 28 isolates recovered from the intraabdominal specimens. The number of isolates ranged from 1 to 3 isolates, with an average of 1.16 aerobic isolates and 0.30 anaerobic isolates per patient. The commonly isolated pathogens were those bacteria considered as normal inhabitants of the gastrointestinal tract, such as *E. coli* and *Bacteroides* species.

Bacteremia was present in 4 patients with inraabdominal infection, 3 of whom grew aerobic organisms and 1 grew anaerobic organism from the blood culture.

Prompt diagnosis and surgical intervention with administration of appropriate antimicrobial agents are essential to the successful management of intraabdominal sepsis. Since both aerobic and anaerobic bacteria were isolated, the rational choice would be a combination of agents effective against both pathogens.

From the data gathered and the difficulties encountered in the study, the following recommendations are given:

1. It is recommended that the study be carried out on a bigger population. Due to the difficulties in patient recruitment, it is suggested that the study be done on a multicenter basis, perhaps involving other tertiary government hospitals.

2. To minimize the factors that could result in poor yield of anaerobes, appropriate anaerobic transport media should be used. However, considering the costs, an alternative would be train one of the surgeons on proper collection and immediate inoculation of specimens into prepared anaerobic culture media even within the operating premises itself if possible.

3. A comparative study can be done to compare the frequency of isolation of anaerobic bacteria using the conventional anaerobic jar system with the use of gas-impermeable plastic bags.

4. Lastly, antimicrobial guidelines regarding appropriate antimicrobial agents, route of administration and duration of therapy should be formulated to ensure rational antimicrobial use. These recommendations should be based on the common etiologic agents isolated and the known susceptibility patterns as shown from results of this study.

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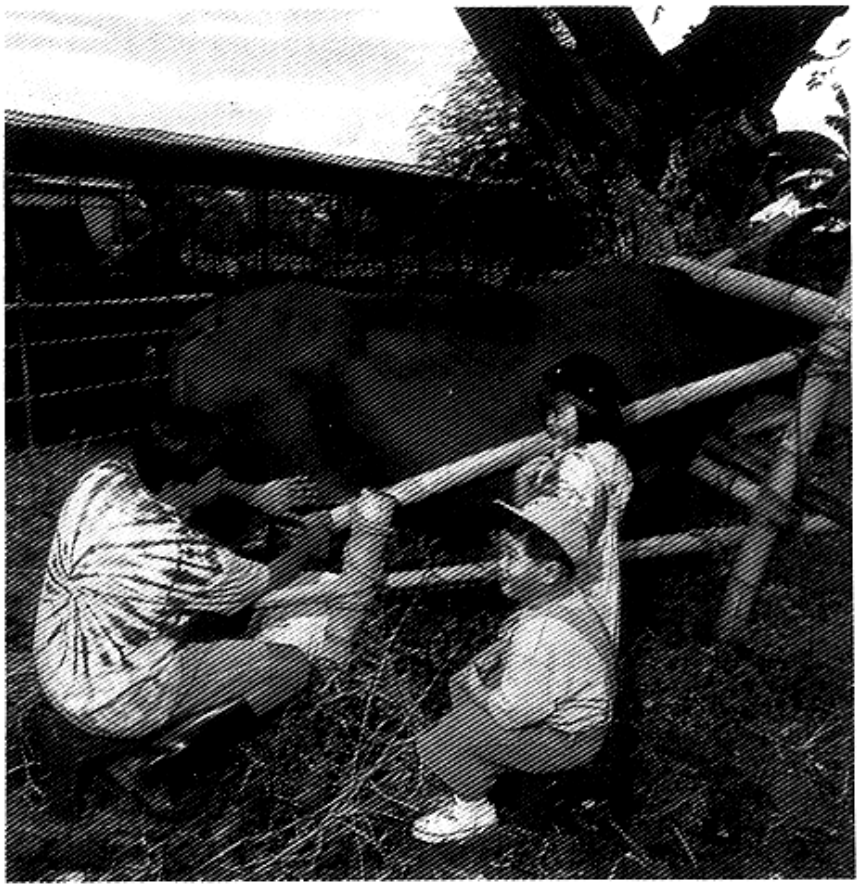

Kapag may tiyaga, may nilaga.