SHORT ARTICLE

Microbiology of retroperitoneal abscesses in children

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Samples of pus from 41 children with retroperitoneal abscess treated between 1974 and 1994 yielded a total of 125 organisms (3.0 isolates/specimen); 58 isolates were aerobic and facultative species (1.4/specimen) and 67 were anaerobic (1.6/specimen). Aerobic bacteria only were isolated from 7 (17%) abscesses, anaerobic bacteria only from 3 (7%) and mixed aerobic and anaerobic bacteria from 31 (76%); 34 (83%) infections were polymicrobial. The predominant aerobic and facultative isolates were *Escherichia coli* (19 isolates) and *Staphylococcus aureus* (6), and the predominant anaerobes were *Peptostreptococcus* spp. (18 isolates), *Bacteroides* spp. (22) and *Prevotella* spp. (5).

Introduction

Retroperitoneal abscesses are often insidious and difficult to diagnose and cause high morbidity and mortality. They comprise infections of four anatomical spaces – anterior retroperitoneal, posterior retroperitoneal, retrofascial and pelvic retroperitoneal [1–4]. Previous studies of the microbiology of retroperitoneal abscesses in adults and children have been limited to infection of only one space [5–10], or did not define the microbiology according to the anatomical space [2, 5, 11] or did not use methods adequate for the recovery of anaerobic organisms [1–4, 10, 11]. Anaerobic bacteria were rarely reported from paediatric cases of retroperitoneal abscesses [10]. This retrospective report summarises the microbiology of retroperitoneal abscesses in 41 children treated over a period of 20 years.

Patients and methods

Patients

The 41 children were treated in the University of California Medical Center (Los Angeles, CA, USA), County Medical Center (Los Angeles, CA), Fairview State Hospital (Costa Mesa, CA), Children's Hospital National Medical Center (Washington, DC) and the

Navy Hospital (Bethesda, MD) between June 1974 and June 1994. Patients were 8 months – 18 years old (average 11.3 years) and 25 were male. Antimicrobial therapy was given to 27 patients before collection of samples.

The abscesses comprised 21 anterior retroperitoneal abscesses (one oesophageal, one duodenal, four pancreatic, 11 from the lower gastrointestinal tract and four of unknown origin), six posterior retroperitoneal (perinephric), seven retrofascial (six psoas and one iliac muscle) and seven pelvic retroperitoneal abscess. The data on the six perinephric abscesses were presented previously [7].

Microbiological examination

Specimens were obtained through open surgical procedures, either by aspiration of the pus into a syringe that was sealed with a rubber stopper after evacuation of the air or by a swab that was transported in an anaerobic transport tube (Port-A-Cul[®], Becton Dickinson Company). The time between collection and culture of specimens was 30 min – 2 h.

Specimens were cultured on sheep blood 5% agar, chocolate agar (both incubated in air with CO₂ 5%) and MacConkey agar (incubated aerobically) at 37°C and examined at 24 and 48 h. For anaerobes, samples were cultured on pre-reduced brucella blood agar with vitamin K₁, blood agar containing kanamycin and vancomycin, blood agar containing phenylethyl alcohol and in thioglycolate broth containing haemin and vitamin K₁ [12]; all were incubated in GasPak[®] jars (Baltimore Biological Laboratories) at 37°C and

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examined after 48 and 96 h. Anaerobes were identified by techniques described previously [12]. Aerobic bacteria were identified by conventional methods [13].

Blood for cultures was drawn from 35 patients, most often from an antecubital vein, after preparation of the area with povidone-iodine, and inoculated at the bedside into two bottles, one for aerobic bacteria and the other for anaerobic bacteria.

Results

A total of 125 isolates (3.0/specimen) was obtained from the abscesses (Table 1); 58 were aerobic and facultative species (1.4/specimen) and 67 (1.6/specimen) were anaerobes. Aerobic bacteria only were isolated from 7 (17%) abscesses, anaerobic bacteria only from 3 (7%) and both aerobic and anaerobic bacteria from 31 (76%). Polymicrobial infection was present in 34 (83%) abscesses; the number of isolates ranged from two to five.

The predominant aerobic and facultative isolates were *Escherichia coli* (19 isolates) and *Staphylococcus aureus* (6), and the predominant anaerobes were *Peptostreptococcus* spp. (18 isolates, including five *P. micros*, three *P. prevotii*, three *P. anaerobius*, two *P. magnus* and one *P. asaccharolyticus*), *Bacteroides* spp. (22, including 11 *B. fragilis*, five *B. thetaiotaomicron*, three *B. vulgatus* and one *B. distasonis*), *Prevotella* spp. (5 – 2 *Pr. intermedia*, two *Pr. melaninogenica*, one *Pr. bivia*) and *Clostridium perfringens* (five).

Sixteen isolates identical to those from the abscesses were cultured from 14 (40%) of the 35 patients from whom blood cultures were collected. These were *E. coli* (six), *Bacteroides* spp. (four), *Peptostreptococcus* spp. (two), *S. aureus* (two), *Klebsiella pneumoniae* (one), *Fusobacterium* spp. (two) and *Clostridium* sp. (one).

Single isolates were obtained in seven (17%) instances – four isolates of *S. aureus* and one each of *E. coli*, *B. fragilis* and *Peptostreptococcus* sp. The number of anaerobic isolates per site generally outnumbered the number of aerobic or facultative isolates. The number of anaerobic isolates was highest in pelvic abscesses (2.1/site). *S. aureus* was more commonly isolated from posterior, retrofascial and pelvic abscesses. *Neisseria gonorrhoeae*, *Pr. bivia* and group B streptococci were isolated only from pelvic abscesses. *Clostridium* spp. were mostly from anterior retroperitoneal sites. *Bacteroides* spp. and *E. coli* isolates predominated in abscesses related to the lower gastrointestinal tract.

Antimicrobial therapy was given and surgical drainage was performed for all patients. The antimicrobial agents used were aminoglycosides (34 cases), clin-

damycin (16), methicillin (15), amoxicillin (11), cefoxitin (7), metronidazole (5), vancomycin (5), ceftazidime (4), imipenem-cilastatin (2), ticarcillin-clavulanate (2) and cefazolin (1).

Predisposing or associated clinical conditions were present in most cases (37; 90%). These included ruptured appendix (nine cases), trauma (eight), previous surgery (seven), remote infection (six), Crohn's disease (four; all psoas abscesses), splenectomy (four), immunodeficiency (three), osteomyelitis (three), diabetes (three), malignancy (three), steroid intake (two), rupture of a hollow viscus (two) and renal transplant (one).

Discussion

This study demonstrated the occurrence of aerobic and anaerobic bacteria in retroperitoneal abscesses in children. Organisms similar to those reported in the present study have been reported from intra-abdominal [14] and subphrenic abscesses [15]. In contrast to previous reports [1–4, 10, 11], this study demonstrated the isolation of anaerobic bacteria from all the retroperitoneal anatomical spaces. Infections of the retroperitoneal spaces usually originate from sites where anaerobic bacteria are part of the normal flora. These include the upper and lower gastrointestinal tract and the vagina and cervix, where anaerobic bacteria are present at concentrations of 10^9 – 10^{11} organisms/ml, outnumbering aerobic and facultative species by 100–1000:1 [16]. The importance of both aerobic and anaerobic components acting synergically in such infections has been demonstrated in experimental studies of animals [17–19]. The virulence factors of the most prevalent anaerobic species, *B. fragilis*, include β -lactamase production [20], elaboration of other enzymes and metabolites, and possession of a capsule [20]. Synergy may be a result of mutual protection from phagocytosis and intracellular killing [21], production of essential growth factors [22] or lowering of oxidation–reduction potentials in host tissues [23].

Management of mixed aerobic and anaerobic infections requires surgical correction and drainage of pus and the administration of antimicrobial agents effective against both aerobic and anaerobic bacteria [24]. Without adequate therapy, infection may persist and abscesses may develop. The environment of an abscess is detrimental to many antimicrobial agents and drainage is necessary when abscesses have developed.

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