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Clindamycin in Treatment of Aspiration Pneumonia in Children

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Twenty-eight patients with anaerobic pleuropulmonary infections were treated with clindamycin alone or clindamycin with gentamicin. Sixteen of the patients presented with pneumonitis, nine with necrotizing pneumonia, and three with lung abscesses. The average length of treatment was 13.8 days, and the duration of temperature after initiation of therapy was 3.1 days. The predominant isolates were anaerobic gram-positive cocci (23 isolates), *Bacteroides melaninogenicus* (14), *Bacteroides fragilis* (9), and *Fusobacterium nucleatum* (11). The most frequent aerobic isolates were alpha-hemolytic streptococci (12), *Diplococcus pneumoniae* (12), *Pseudomonas aeruginosa* (9), *Klebsiella pneumoniae* (7), group A beta-hemolytic streptococci (5), *Staphylococcus aureus* (9), and *Escherichia coli* (6). All patients responded to the therapy and were cured of the infection. There were no side effects observed from the administration of clindamycin. None of the patients developed any blood dyscrasia, liver damage, diarrhea, or colitis. Clindamycin appears to be effective in the treatment of mixed aerobic and anaerobic pleuropulmonary infections in children, alone or with an aminoglycoside when indicated.

Aspiration pneumonia is common in pediatric patients who suffer from acute or chronic neurological disorder which alters their consciousness, gag reflex, or swallowing mechanism. The aerobic and anaerobic bacteriology of such infections has been studied in adults (1, 6), using transtracheal aspiration or direct lung puncture. Aspiration pneumonia in children, however, has not been studied in the past with the above methods, which allow bypass of the normal mouth flora.

The role of anaerobic bacteria in aspiration pneumonia in pediatric patients was recently demonstrated (I. Brook and S. M. Finegold, Pediatr. Res. 11:568, 1977). It was found that the isolates from those patients are usually a mixture of aerobic and anaerobic organisms.

Selection of appropriate antimicrobial therapy for aspiration pneumonia may be difficult, particularly if one of the causative organisms is *Bacteroides fragilis*. This pathogen is generally resistant to antibiotics used in the treatment of systemic infections, including penicillin. Recent in vitro and clinical data (3, 7) suggest that anaerobic bacteria are usually susceptible to clindamycin. We present our experience using clindamycin alone or combined with an aminoglycoside in the treatment of aspiration pneumonia in pediatric patients.

MATERIALS AND METHODS

Twenty-eight pediatric patients diagnosed to have aspiration pneumonia were included in the final analysis. None of the patients was treated before collection of the specimen for culture. The patients were residents of Fairview Hospital for prolonged periods of time. Sixteen patients suffered from mental retardation, and 12 patients suffered from brain damage due to congenital or acquired disorders. The patients were divided according to their clinical and roentgenographic features into the following groups: (i) pneumonitis, where there was a pulmonary infiltrate with no evidence of cavitation; (ii) necrotizing pneumonia, where patients presented with multiple small pulmonary cavities less than 2 cm in diameter; (iii) pulmonary abscess, where at least one solitary pulmonary cavity more than 2 cm in diameter was present.

Transtracheal aspirations were performed before administration of antimicrobial agents (1). Specimens were transported immediately to the Bacteriology Laboratory to be inoculated for isolation of aerobic and anaerobic bacteria and were incubated within 5 to 10 min. Aerobic and facultative organisms were identified by conventional methods. Anaerobic isolates were identified according to previously described methods (10). Direct Gram stain of all aspirates was done and read immediately. All patients were started

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on parenteral administration of clindamycin phosphate, 25 to 40 mg/kg per day, in three divided doses.

An aminoglycoside, gentamicin, was added to clindamycin when gram-negative enteric bacilli were seen in large quantities, in the Gram stain of the aspirate or 24 h later in the aerobic culture. In cases where aminoglycoside therapy was initiated because gram-negative bacteria were seen on direct Gram stain of the aspirate, but those organisms did not grow in the culture media, the aminoglycoside therapy was discontinued within 48 h. In some of these instances, gram-negative anaerobic bacteria were subsequently isolated. The aminoglycoside was given in a dose of 3 to 6 mg/kg per day in three divided dosages. Clindamycin was administered parenterally for at least 5 days, and thereafter, when conditions permitted, it was given orally in the same manner for at least 10 days depending on the patient's clinical condition. The aminoglycoside was administered parenterally for at least 7 days. The criteria for discontinuation of the antimicrobial therapy were based on the patient's clinical and radiological response to therapy. Marked improvement in the radiological findings, rate of defervescence, physical findings, and a return to normal of the leukocyte count were among the criteria used to determine the length of therapy.

Postural drainage, repeated suctioning, and respiratory and physical therapy were used in all patients. No steroids were given in the instances where aspiration was observed. All patients had complete blood count, renal and hepatic function tests, and urinalysis done before, during, and after completion of therapy.

RESULTS

Twenty-eight patients, 18 males and 10 females, were included in this study. Their ages ranged from 6 months to 14 years (mean: 8 years, 2 months). Conditions which predisposed to aspiration were present in many of the patients. Altered or compromised consciousness was present in 19 patients. Periodontitis was present in 18 patients, seizure disorder in 12, and dysphagia in 9. An incident of aspiration was observed in 14 of the patients. They were divided into two groups. Group I consisted of 16 patients treated with clindamycin alone (Table 1). These patients presented with aspiration pneumonia where aerobic and anaerobic bacteria were isolated, but aerobic enteric gram-negative bacilli were not predominant. Group II consisted of 12 patients who were treated with clindamycin and gentamicin. These patients presented with aspiration pneumonia where aerobic and anaerobic bacteria were isolated, but aerobic gram-negative bacilli were more predominant. The patients in group II tended to be more severely sick, as is shown in Table 1 and is evident from their temperature and time of defervescence.

Pneumonitis was more common in the first group, whereas cavitation was more frequent in the second group. The average duration of temperature after initiation of therapy was 2.5 days in the first group and 3.8 days in the second, and the average length of treatment was 12.4 days in the first group and 15.8 days in the second group (Table 1).

The first group consisted of ten patients with pneumonitis, five with necrotizing pneumonia, and one with lung abscess (Table 1). Most of the patients presented with mixed aerobic and anaerobic infections where multiple anaerobic bacteria were isolated from each aspirate. After initiation of clindamycin therapy, patients tended to defervesce within 1 to 3 days (average, 2.5 days); their clinical course was benign, and all of them recovered.

The second group of patients, treated with clindamycin and gentamicin, consisted of six patients with pneumonitis, four with necrotizing pneumonia, and two with lung abscesses. The bacteriology of those patients is presented in Table 2. There are some differences between the bacteria in the two groups. Gram-negative aerobic bacilli, especially *Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae,* and *Serratia marcesens* were more frequently isolated in the second group, which also accounted for the higher ratio of bacteria per specimen in that group. *Fusobacterium nucleatum* was more frequently isolated in the second group, whereas

TABLE 1. *Clinical data of 16 patients treated with clindamycin and 12 patients treated with clindamycin and gentamicin*

Treatment	Patients			Avg temp (°F)	Duration of fever (days)		Diagnosis (no. of patients)			Avg length of treatment (days)
	Avg age	Sex			Before treatment	After start of therapy	Pneumonitis	Necrotizing pneumonitis	Lung abscess	
		M	F							
Clindamycin	7 yr, 8 mo	11	5	102.8	2.5	2.5	10	5	1	12.4
Clindamycin and gentamicin	7 yr, 4 mo	7	5	103.6	2.5	3.8	6	4	2	15.8
Both groups (total)	7 yr, 5 mo	18	10	103.2	2.5	3.1	16	9	3	13.8

TABLE 2. *Bacterial isolates in 16 patients treated with clindamycin and 12 patients treated with clindamycin and gentamicin*

Isolates	No. from patients treated with:	
	Clindamycin	Clindamycin and gentamicin
Aerobic and facultative		
Gram-positive cocci		
Streptococcus pneumoniae	7	5
Alpha-hemolytic streptococci	8	4
Group A beta-hemolytic streptococci	3	2
Staphylococcus aureus	6	3
Staphylococcus epidermidis	2	2
Gram-negative bacilli		
Haemophilus influenzae	3	3
Haemophilus parainfluenzae	1	1
Proteus sp.		1
Pseudomonas aeruginosa	2	7
Serratia marcescens		3
Escherichia coli	1	5
Klebsiella pneumoniae	2	5
Enterobacter sp.		1
Total aerobes	35	42
Cocci		
Peotococcus sp.	8	6
Peotostreptococcus sp.	6	3
Veillonella sp.	2	1
Microaerophylic streptococci	2	
Gram-positive bacilli		
Lactobacillus sp.	2	3
Bifidobacterium sp.	1	1
Eubacterium sp.	2	
Leptotrichia buccalis		1
Propionibacterium acnes	1	
Clostridium ramosum	1	
Gram-negative bacilli		
Fusobacterium nucleatum	5	6
Fusobacterium mortiferum		1
Bacteroides sp.	3	2
Bacteroides oralis	2	4
Bacteroides corrodens	1	1
Bacteroides ruminicola subsp. *brevis*	3	
Bacteroides melaninogenicus	8	6
Bacteroides fragilis	3	
Bacteroides vulgatus	3	1
Bacteroides distasonis	1	1
Total anaerobes	54	37
Total number of bacteria	89	79

B. fragilis was more commonly isolated in the first group.

The most frequent anaerobic isolates were anaerobic cocci (23 isolates), *Bacteroides melaninogenicus* (14), *B. fragilis* (9), and *F. nucleatum* (11). The most frequent aerobic isolates were alpha-hemolytic streptococci (12 isolates), *Streptococcus pneumoniae* (12), *P. aeruginosa* (9), *K. pneumoniae* (7), *Staphylococcus aureus* (9), *E. coli* (6), and group A beta-hemolytic streptococci (5). The bacteriology of the tracheal aspirates demonstrated the polymicrobial etiology of the aspiration pneumonia, with an average of 3 anaerobes and 2.4 aerobes per specimen.

Definite clinical and roentgenographic improvement occurred in all of the patients, including those with pulmonary abscesses. None of the patients showed liver enzyme elevations or hematological abnormality while on therapy. There were no cases of diarrhea or colitis noted in the patients.

DISCUSSION

Clindamycin is an effective drug in the treatment of anaerobic pleuropulmonary infections in children and adults. Its efficacy in treatment of pleuropulmonary infections in adults has been demonstrated in the past (3, 7).

The polymicrobial etiology of aspiration pneumonia in children seems to be similar to that in adults, where anaerobic bacteria are almost always isolated along with aerobic bacteria, including gram-negative enteric bacilli. Additional coverage for aerobic gram-negative enteric bacilli is often indicated to control those organisms and has been advocated by many authors (11). Clindamycin is an effective drug in the treatment of penicillin-resistant anaerobic bacteria and *S. aureus* (9). Since 9 of the patients presented with *B. fragilis* isolates, which are resistant to penicillin, and 13 of them presented with *B. melaninogenicus*, in which penicillin resistance has also been found recently (P. R. Murray and J. E. Rosenblatt, Program Abstr. Intersci. Conf. Antimicrob. Agents Chemother. 16th, Chicago, Ill., Abstr. no. 457, 1976), clindamycin has the advantage of being active against those anaerobic organisms as well as against *S. aureus*. The usage of clindamycin as a single drug in 16 cases in our study and in 12 cases combined with gentamicin has shown it to be effective in the treatment of aspiration pneumonia in children. Penicillin is still regarded as the drug of choice for the treatment of anaerobic lung infections by most authors. Bartlett and Gorbach (2) reported that penicillin was as effective as clindamycin in anaerobic lung infections in adults, even when *B. fragilis* was isolated. However, other workers

reported that a combination of clindamycin and gentamicin therapy may be necessary to treat severe mixed aerobic and anaerobic infections (A. W. Chow, J. Ota, and L. P. Guze, Program Abstr. Intersci. Conf. Antimicrob. Agents Chemother., 14th, San Francisco, Calif., Abstr. no. 288, 1974). Finegold recommended using an agent active against *B. fragilis* isolated from severe cases of pleuropulmonary infection, especially in necrotizing pneumonia (5). Further studies in pediatric patients are needed, however, to determine whether penicillin would not have been as effective as clindamycin in the treatment of aspiration pneumonia in pediatric patients.

Recent reports described the development of diarrhea and colitis after clindamycin therapy in adults (4). The lack of occurrence of diarrhea or colitis among our patients confirms the report of the rarity of this complication in pediatric patients (8, 9). Whether clindamycin alone could be used in treatment of those infections or whether an aminoglycoside should be added to the drug regime is a decision that should be made in each individual case. It is obvious that the presence of gram-negative bacilli in the aspirate culture would not automatically indicate that an aminoglycoside is indicated, and we have found in our experience that this is warranted only in very seriously ill patients or where gram-negative bacilli are present in proportionally large numbers.

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LITERATURE CITED

1. **Bartlett, J. E., and S. M. Finegold.** 1974. Anaerobic infections of the lung and pleural space. Am. Rev. Respir. Dis. **110**:56–57.
2. **Bartlett, J. B., and S. L. Gorbach.** 1975. Treatment of aspiration pneumonia and primary lung abscess. Penicillin G vs. clindamycin. J. Am. Med. Assoc. **234**: 935–937.
3. **Chow, A. W., J. Z. Montgomerie, and L. B. Guze.** 1974. Parenteral clindamycin therapy for severe anaerobic infections. Arch. Intern. Med. **134**:78–82.
4. **Cohen, L. F., C. J. McNeil, and R. F. Wells.** 1973. Clindamycin associated colitis. J. Am. Med. Assoc. **223**: 1379–1380.
5. **Finegold, S. M.** 1977. Anaerobic bacteria in human disease, p. 253. Academic Press Inc., New York.
6. **Gorbach, S. L., and J. G. Bartlett.** 1974. Anaerobic infections. II. N. Engl. J. Med. **290**:1237–1245.
7. **Gorbach, S. L., and H. Thadepalli.** 1974. Clindamycin in the treatment of pure and mixed anaerobic infections. Arch. Intern. Med. **134**:87–92.
8. **Randolph, M. F., and K. E. Morris.** 1977. Clindamycin-associated colitis in children. A prospective study and a negative report. Clin. Pediatr. **16**:722–725.
9. **Rodriguez, W., S. Ross, W. Khan, D. McKay, and P. Moskowitz.** 1977. Clindamycin in treatment of osteomyelitis in children. A report of 29 cases. Am. J. Dis. Child. **131**:1088–1093.
10. **Sutter, V. L., V. L. Vargo, and S. M. Finegold.** 1975. Wadsworth anaerobic bacteriology manual, 2nd ed. Extension Division, University of California, Los Angeles.
11. **Thadepalli, H., A. H. Niden, and J. T. Huang.** 1976. Treatment of anaerobic pulmonary infections. Chest **69**:743–746.