The Bacteriology of Chronic Destructive Pneumonia

P. C. APPELBAUM, E. W. J. CAMERON, W. S. HUTTON, SHEILA A. CHATTERTON, CHARLENE W. AFRICA

SUMMARY

Thirty-four patients with chronic destructive pneumonia (CDP) were investigated bacteriologically and mycologically; specimens were obtained by transtracheal aspiration, percutaneous lung puncture, and open lung biopsy. Anaerobes were isolated in the absence of aerobes in 1 case while specimens from 9 patients yielded aerobes only. In 16 patients both groups of organisms were cultured. *Streptococcus viridans* was isolated in 12 cases and fungi in 2 cases. Specimens from 8 patients were sterile on culture. All patients had been treated with various antibiotic combinations before specimens were taken. Aerobes, particularly Gram-positive cocci, and anaerobes probably play an important synergistic role in the pathogenesis of CDP.


Chronic destructive pneumonia (CDP) is a pulmonary infection found in South Africa which particularly affects Black men in the 20-50-year age group.\(^1\)\(^2\) Antimicrobial agents and physiotherapy frequently fail to heal CDP and resection of the lesion may then be mandatory. Postoperative morbidity and mortality rates are high and it was inferred from a study of the results of operative management\(^1\) and from observation of the response of the disease to medical treatment that the aetiology of CDP was incompletely understood.

The precise role of bacteria in the pathogenesis of CDP in the South African context has not yet been elucidated. This report describes a prospective survey of the bronchopulmonary microbiology in 34 consecutive cases of CDP. Specimens were taken by techniques designed to optimize yields of aerobic and anaerobic bacteria.

MATERIALS AND METHODS

Specimen collection. Specimens from 34 patients with CDP\(^7\) were taken by percutaneous transtracheal aspiration, lung puncture, and/or open lung biopsy.\(^8\) Aspirates were transported to the laboratory in gassed-out tubes, and biopsy specimens in anaerobic mini-jars.\(^8\) All specimens reached the laboratory within 20 minutes and were processed immediately. Sputum specimens from each patient were also examined for bacteria and fungi by aerobic culture. Anaerobic sputum culture was not done.\(^7\)

Anaerobic incubation. A heated anaerobic glove box\(^9\) (Coy Manufacturers, Ann Arbor, Michigan) was used. Plates were incubated at 37°C for at least 48 hours.

Processing of specimens. Biopsy specimens were blended in an MSE homogenizer for 1-5 minutes, using gassed-out 5-ml bottles. Aspirates and homogenates were Gram-stained before streaking on blood agar (one plate incubated under 5% CO\(_2\), the other aerobically), Thayer-Martin (aerobic), Sabouraud (aerobic; incubation at 22°C), enriched blood agar\(^6\) (anaerobic), and enriched neomycin (75 µg/ml) laked blood agar\(^6\) (anaerobic) media.

Characterization of strains. Aerobes and fungi were identified by standard methods.\(^6\) Anaerobe identification was according to the method of the Virginia Polytechnic Institute Anaerobe Laboratory\(^6\) using pre-reduced anaerobically sterilized media and gas-liquid chromatography (Model 920 Varian Aerograph, Zug, Switzerland).

RESULTS

In 47.1% of cases, both aerobes and anaerobes were isolated. Aerobes only were isolated in 26.5% of patients. One patient yielded a pure growth of *Bacteroides melaninogenicus* ss. *intermedius*, in the absence of aerobes, from a transtracheal aspirate. No growth was obtained in 8 cases, and in 2 patients yeasts were cultured in conjunction with aerobic and anaerobic organisms.\(^*\)

The most commonly encountered aerobic bacteria were *Streptococcus faecalis*, *β*-haemolytic streptococci, *S. viridans* (the latter in 35.3% of patients), *Staphylococcus aureus*, *S. epidermidis*, *Haemophilus influenzae*, *H. parainfluenzae*, and enterobacteriaceae (*Klebsiella pneumoniae*, *Enterobacter* species, *Serratia marcescens*). *B. melaninogenicus* and *B. oralis* were the most common anaerobes cultured, being isolated in 20.6% and 8.8% of cases respectively. Other anaerobes comprised one or two isolates of other species — *Clostridium butyricum*, *C. limosum*, *Eubacterium lentum*, *Peptococcus magnus*, *Peptococcus* species (unidentified), *B. capillosus*, *B. coagulans*, *Bacteroides* species (unidentified), and *Fusobacterium nucleatum*. *B. fragilis* was isolated from 2 patients only.

Organisms isolated from sputa included *β*- and *α*-haemolytic streptococci, *S. pneumoniae*, *K. pneumoniae*, *Proteus* species, *H. influenzae*, and *H. parainfluenzae*.

DISCUSSION

Because CDP is diagnosed after exclusion of infectious processes such as lobar pneumonia or tuberculosis,\(^1\) antibiotic therapy before microbiological investigation is the rule in patients with CDP. In our series, all 34 patients had received various regimes of antimicrobials.
before being examined for lower respiratory tract microorganisms. The absence of organisms in 8 cases could therefore have been due to eradication of pathogenic bacteria by antibiotics. Although the nature of these antibiotic-sensitive organisms is unknown, they may have contributed to the pathogenesis of CDP in these patients. Failure to isolate anaerobes in 3 patients in spite of clinically putrid aspirates may also reflect prior antibiotic therapy.

Factors which could have led to persistence of bacterial pathogens despite antibiotic therapy include: bacterial resistance, failure of antimicrobials to penetrate lesions due to the extensive pulmonary necrosis characteristic of CDP, and recurrent and variable re-infection of a damaged lung from the upper respiratory tract. Isolation of similar aerobic organisms from sputum and lower respiratory tract specimens in several cases lends support to the latter hypothesis.

The high isolation rate of \textit{S. viridans} from lower respiratory tract specimens could be due to colonization with upper respiratory tract flora, after treatment with antibiotics. Although \textit{S. viridans} is generally not thought to be pathogenic in the respiratory tract, Kerr\textsuperscript{5} has reported pure culture of these organisms in a patient with bronchiectasis for bronchial carcinoma. Isolation of \textit{S. viridans} may also reflect re-infection of a damaged lung with upper respiratory tract flora, as described above. Isolation of \textit{S. epidermidis} strains probably reflects contamination of specimens with skin flora.

The spectrum of anaerobes isolated differs from that previously described in cases of anaerobic infection of the respiratory tract.\textsuperscript{6,9-12} Isolation rates of \textit{Fusobacterium} and anaerobic cocci were low, the most common isolates being \textit{B. melaninogenicus} and \textit{B. oralis}. Low isolation rates of \textit{B. fragilis} probably reflect a minor role played by this organism in the pathogenesis of CDP. The finding of mixed cultures is evidence in favour of synergism between bacterial species causing the parenchymal necrosis characteristic of CDP. Knowledge of the role played by bacteria in the pathogenesis of CDP is necessary for the rational formulation of antimicrobial regimens in the treatment of this disease.

This study was supported by grants from the Group Chairmen's Fund of the Anglo American Corporation, and the South African Medical Research Council.

REFERENCES