

Bacteroides Infection among Hospital Patients

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Summary

In an 18-month period a total of 118 isolates of *Bacteroides* species, mainly *Bacteroides fragilis*, were grown from 112 hospital patients with various conditions. The infections were severe and were associated with serious operations such as intestinal surgery for carcinoma and postpartum hysterectomy. Blood cultures were often found to be positive too late in the course of infection for prompt and successful antibiotic therapy to be given. All the *Bacteroides* species tested were sensitive to clindamycin and co-trimoxazole. We suggest that clindamycin should be added to an empirical antibiotic regimen for the treatment of patients prone to the infection.

Introduction

Bacteroides species are often present in suppurative lesions in man, but the clinical importance of this potential pathogen is not always fully realized. Reasons for this lack of realization and clinical interest may be due partly to the fact that the organism is not often isolated from clinical material, produces only mild wound infections in most cases, and has been isolated from the intestinal and vaginal tracts as a harmless commensal (Hite *et al.*, 1947; Wilson and Miles, 1964; Moore and Cato, 1969). Nevertheless, a steady stream of reports on infections caused by *Bacteroides* has continued to appear since 1898, when it was first recognized that the organism was a human pathogen (Veillon and Zuber, 1898). Within the last four years such reports have increased in number. MacLennan (1951), Gillespie and Guy (1956), and Gunn (1956) indicated that these infections usually follow surgery of the intestinal tract or of obstetric and gynaecological conditions. The most severe infections are seen in the older age group of patients suffering from serious underlying diseases such as carcinoma (Gelb and Seligman, 1970; Goodman *et al.*, 1970; Ellner and Wasilaukas, 1971), and in women with postpartum infections (Rotheram and Schick, 1969; Pearson and Anderson, 1970).

Other infections have also been reported—for example, oropharyngeal sepsis (Gunn, 1956), lung abscess (Tillotson and Lerner, 1968), brain abscess (Ingham *et al.*, 1970), and septicaemia associated with shock, jaundice, thrombophlebitis, and articular lesions (Tynes and Frommeyer, 1962).

The common infecting species is *Bacteroides fragilis*, which is usually resistant to penicillin but nearly always sensitive to erythromycin, lincomycin, chloramphenicol, and clindamycin, which has been said to be the drug of choice (Ingham *et al.*, 1968; Tracy *et al.*, 1972; *Lancet*, 1973).

Within the past two years the rate of isolations of *Bacteroides* from clinical material such as pus, swabs, and blood cultures

received in this laboratory has increased enormously, and we report on our experience of the organisms with details of some of the patients involved. The reason for the increase in isolations is not apparent, but was not due to a change in technical personnel or methods used for culture. However, after it was realized that there was an increase in the incidence of isolations two changes were made: (1) direct anaerobic culture was carried out of all wound and pus swabs and of all high vaginal swabs from patients who had a vaginal discharge; and (2) blood agar plates containing neomycin were used for culture.

Materials and Methods

BACTERIOLOGICAL METHODS

Swabs and pus were cultured on nutrient agar containing 5% horse blood, and incubated at 37°C in Baird-Tatlock cold catalyst jars containing 95% hydrogen and 5% CO₂. Aerobic cultures were also set up. Cultures were examined daily and reincubated when necessary for up to three days. Blood cultures were taken in two bottles—a 250-ml medicine flat bottle containing home-made cooked meat broth medium, and a 250-ml bottle containing a nutrient agar slope and 50 ml glucose broth. Blood cultures were incubated at 37°C for up to two weeks before discarding.

IDENTIFICATION OF ORGANISMS

Non-sporing obligate anaerobes which were Gram-negative rods were accepted as *Bacteroides* species, 60 strains of which were tested further for biochemical characteristics using methods described by Ingham *et al.* (1968) and Cowan and Steel (1965).

ANTIBIOTIC SENSITIVITY

Sensitivity tests were carried out routinely by the disc-diffusion method using Mastrings (Mast Laboratories) on nutrient agar containing 5% horse blood, except when testing for sulphonamide and co-trimoxazole sensitivity for which lysed horse blood was used, and DST (Oxoid) agar.

The routine antibiotics on the rings included penicillin 0.6 µg, ampicillin 10 µg, erythromycin 5 µg, clindamycin 2 µg, co-trimoxazole containing 23.5 µg of sulphamethoxazole and 1.5 µg trimethoprim, and tetracycline 10 µg.

CLINICAL DATA

Clinical information on 77 out of 112 patients was collected from case histories, noting particulars of diagnosis, operations, antibiotics given, age, sex, length of stay in hospital, infections, and progress. The case histories of the 77 patients reviewed included 26 cases of acute appendicitis, 22 other bowel operations, 24 obstetric and gynaecological diseases, and eight miscellaneous conditions. The records of the remaining 35 of the 112 patients were inadequate or not available for review.

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Results

SOURCES OF ISOLATIONS

A total of 118 strains of *Bacteroides* species were isolated in an 18-month period, January 1971 to June 1972, from 112 patients, including the 77 with adequate records mentioned above. Most isolations, 74 (62.7%), were from patients who had had abdominal surgery. Of these, 41 were from cases of acute appendicitis. Twenty-nine (24.6%) isolations were made from patients with gynaecological and obstetric conditions. The remaining isolates were from a miscellaneous group of 15 patients, 12.7% of the total. The details are given in table 1.

TABLE 1—Sources of 118 *Bacteroides* Isolations from 112 Patients

	No. of Isolates
Group 1—Associated with abdominal surgery	
Peritoneal swabs, appendix abscesses	13
Postoperative wounds:	
Appendicectomy	28
Resection, carcinoma of colon	9
Laparotomy, diverticular disease	8
Pancreatitis	1
Gastrectomy	1
Empyema of gall bladder	5
Graft, aortic aneurysm	1
Hernial repair	1
Blood cultures after abdominal surgery	7
Total	74
Group 2—Associated with gynaecological diseases	
Postoperative wounds:	
Hysterectomy, and D and Cs	15
Caesarean section	2
High vaginal swabs:	
Postpartum pyrexia	9
Septic abortion	2
Blood cultures after total hysterectomy	1
Total	29
Group 3—Associated with miscellaneous conditions	
Abscesses:	
Ischiorectal	2
Perianal	3
Postoperative wound swabs:	
Block dissection, groin	1
Bed sore	1
Priapism, attempted repair	1
Basal cell carcinoma	1
Carcinoma of vulva	1
Nephrectomy wound	1
Prostatectomy wound	1
Blood cultures:	
Postoperative prostatectomy	1
" haemangioma	1
Two-year-old child with diarrhoea and urinary tract infection	1
Total	15

TABLE III—Details of Patients who Died

Diagnosis	Age	Operation	Certified Cause of Death
Pancreatitis	68	Exploratory laparotomy	Acute haemorrhagic pancreatitis with abscess formation
Duodenal ulcer	57	Vagotomy and pyloroplasty	Pulmonary embolus
Carcinoma of colon	77	Exploratory laparotomy. Inoperable carcinoma hepatic flexure	Irreversible heart failure
Carcinoma of rectum	61	Inoperable carcinoma of rectum	Bronchopneumonia
Abdominal aortic aneurysm	71	Aortic graft. Resection of gangrenous bowel	Faecal peritonitis
Diverticulitis	65	Perforated and abscess formation	Pulmonary embolus
Villous adenoma of rectum	68	Anterior resection	Myocardial infarction
Motor accident	36	Splenectomy. Large bowel resection	Motor accident. Faecal peritonitis

TABLE II—Details of Patients who had Septicaemia

Sex	Age	Clinical Condition	Antibiotic Given*	Progress	Certified Cause of Death
F.	55	Abdominal hysterectomy. Bowel resection for infarction of large bowel	Appropriate	Recovered	Nil
M.	71	Resection of abdominal aortic aneurysm. Bowel infarction. Peritonitis	Inappropriate	Died	Peritonitis
M.	68	Resection of a villous adenoma of rectum. Peritonitis	Inappropriate	Died	Faecal peritonitis
M.	74	Carcinoma of rectum	Appropriate	Recovered	Nil
F.	78	Liver abscess drained	Inappropriate	Recovered	Nil
F.	12	Appendicectomy. Pelvic abscess. Subphrenic abscess	Appropriate	Recovered	Nil
M.	2	Urinary tract infection. Diarrhoea	Appropriate	Recovered	Nil
F.	42	Postpartum abdominal hysterectomy	Appropriate	Recovered	Nil
M.	36	Motor accident. Splenectomy. Bowel resection. Peritonitis	Inappropriate	Died	Motor accident
M.	61	Carcinoma inoperable	Inappropriate	Died	Faecal peritonitis
M.	65	Diverticulitis. Perforated abscess. Pulmonary embolus	Inappropriate	Died	Bronchopneumonia
					Pulmonary embolus

*Appropriate = Antibiotic to which laboratory reported the organism sensitive. Inappropriate = Antibiotic to which laboratory reported the organism resistant.

PURE OR MIXED INFECTIONS

Bacteroides were usually isolated with other organisms such as anaerobic streptococci, beta-haemolytic streptococci, *Streptococcus faecalis*, *Staphylococcus aureus*, *Escherichia coli*, and, less often, *Proteus* species and *Pseudomonas aeruginosa*. These other organisms, apart from anaerobic streptococci, were usually isolated one to three days before the *Bacteroides*. Pure growths of *Bacteroides* species were secured in 10 (38%) of the 26 acute appendicitis cases, 6 (27%) of 22 in the other bowel operations, 20 (83.3%) of 24 in the obstetric and gynaecological cases, and 2 (25%) of 8 in the miscellaneous group. These isolations seem to indicate that pure growths came more often from swabs of infections associated with a vaginal origin rather than an intestinal one.

ANTIBIOTIC SENSITIVITY

Sixty of the 118 strains were identified as *B. fragilis*. Of these, 59 were fully sensitive to clindamycin, 42 to erythromycin, and 40 to tetracycline. Fifty-nine were resistant to penicillin G and 56 to ampicillin. Only 29 strains were tested against cotrimoxazole, and all were sensitive.

ANTIBIOTIC TREATMENT

Of the 77 patients whose cases were reviewed 23 (30%) received appropriate antibiotics and 54 (70%) did not. However, most of the 54 patients who did not receive the appropriate antibiotics responded well to surgical treatment such as drainage of wound or abscess, and antiseptic wound dressings. Thirteen patients received mixtures of appropriate and inappropriate antibiotics because of mixed infections.

SEPTICAEMIC PATIENTS

Blood cultures were positive from 11 of the 77 reviewed patients, of whom three died. In most cases the blood cultures were taken late in the disease and bacteriological reports reached the clinicians too late for appropriate antibiotic therapy. The details of these patients are given in table II.

DEATHS

There were eight deaths among the 77 patients (table III). Seven were elderly and seriously ill with either acute inflammatory disease or cancer. Two of these died of pulmonary emboli. The eighth was a 36-year-old man who died after a motor accident.

Discussion

Infections caused by *Bacteroides* should be treated early in order to diminish the incidence of morbidity and mortality (Bodner *et al.*, 1970; Ellner and Wasilaukas, 1971). Therefore bacteriological investigations should be carried out as soon as possible, and swabs should be cultured within three hours of being taken in order to prevent strict anaerobes from dying out. It was not possible to do this for all the specimens in this series. Specimens taken at operations out of laboratory hours are now being dealt with on an "on call" basis to avoid delay before culture. This has led to an increase in positive results and early reporting of sensitivity tests.

The strains of *Bacteroides* reported here were resistant to penicillin and ampicillin, therefore other antibiotics should be used to treat the infections. Our results confirm that clindamycin is the drug of choice as suggested by the in-vitro studies of Ingham *et al.* (1968), Kislak (1972), and the report of Tracy *et al.* (1972). Other antibiotics may be useful, however, especially erythromycin and lincomycin, which may be given parenterally as well as by mouth. Our in-vitro sensitivity patterns suggest that many of the infections might have responded to co-trimoxazole, but the use of the drug in this infection needs clinical evaluation.

It is difficult to assess the importance of *Bacteroides* as a cause of death in the patients who had concomitant serious disease. Among the septicæmic patients, however, it is perhaps worth noting that of the five treated with clindamycin all survived, whereas of four not so treated only one survived.

Septicæmia may affect any age group from the very young with appendicitis to the elderly with carcinoma. It is necessary to secure early blood cultures from patients—particularly those

where the source of infection is either the bowel or vagina. In this group it is probably worth while adding clindamycin or lincomycin to the antibiotics to be given empirically, as already suggested in *Lancet* (1973).

In this series there was no evidence of bleeding disorder said to be due to a heparinase produced by *Bacteroides* species (Gesner and Jenkins, 1961; Tracy *et al.*, 1972).

We wish to thank the many clinicians who made the clinical data available for us to review.

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MEDICAL MEMORANDA

Regression of the Forbes-Albright Syndrome after Pituitary Apoplexy

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Although pituitary tumours are known to undergo spontaneous infarction, the usual effect of this is pituitary apoplexy with acute necrosis of the gland and subsequent hypopituitarism. We report a case of the Forbes-Albright syndrome in which such an episode resulted in noticeable improvement in endocrinological function, with subsequent pregnancy, but later relapse.

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Case History

The patient was a 42-year-old white woman with no significant past history. In 1966 she had an uncomplicated delivery of her fourth child. Lactation was suppressed with oestrogens and her periods returned. A year later she developed permanent amenorrhoea, intermittent galactorrhoea, and migrainous headaches. These continued for four years until the beginning of March 1971, when she suddenly developed a much more severe headache. On 7 April she awoke with a partial left ptosis. The headache and ptosis regressed spontaneously over seven weeks. A skull x-ray picture showed an abnormal pituitary fossa, and a lumbar air encephalogram showed a minimal filling defect in the cisterna chiasmatica presumably due to the presence of a pituitary tumour. Endocrine investigation at this time showed a protein bound iodine of 4.7 µg/100 ml triiodothyronine resin of 29% (normal 25-35%), and urinary gonadotrophin of > 2.0 mg I.R.P.2 HMG/24 hours (normal value for human menopausal gonadotrophin, international reference preparation No. 2 is 0.2-1.8). There was a normal cortisol but reduced growth hormone response to hypoglycaemia (table I). It was decided not to treat her at this time because of the risk of radiotherapy causing further pituitary gland necrosis after this pituitary apoplexy.

Her galactorrhoea and headache disappeared and she became pregnant two months after discharge on 9 July. Because of the possibility of pregnancy increasing the growth of her pituitary