THE BACTERIOLOGY OF THE OBSTRUCTED BILIARY TREE

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THE BACTERIOLOGIST'S IMPRESSIONS of infections of the obstructed biliary tree tend to be biased by the memory of particularly difficult cases, and the situation is in fact not quite so bad as it may seem. In order to obtain actual facts and figures for bacteria isolated from bile taken at operation and their antibiotic sensitivities we have carried out a retrospective survey of a random selection of 100 patients with biliary obstruction operated upon by Mr. Rodney Smith during the past 10 years, 1962–72. Virtually all these patients suffered from chronic disease of the biliary tree, and most had undergone repeated surgery elsewhere, with an average of just under 3 previous operations each, before presenting at St. George's Hospital. The antibiotic therapy accompanying these operations and the long periods of antibiotic treatment given in attempts to avoid further operations probably account for the presence of some unusually resistant organisms in the bile.

The 100 patients consisted of 58 women and 42 men with ages ranging from 10 to 73 years (average 48 years). Most patients presented with jaundice and many had chills and rigors. In the majority the obstruction was due to bile duct stricture following previous cholecystectomy; this occurred in 86 patients. Seven patients had stones in the common bile duct, 2 had carcinoma of the bile duct, 1 carcinoma of the pancreas, 2 hepatic cysts, and 2 secondary carcinomas of the liver. These patients underwent a total of 142 operations. Twelve died during the survey period after operation.

All patients had bile taken at each operation and sent to the laboratory as quickly as possible for culture. Of the 142 specimens of bile, 114 (80%) were infected and 28 were sterile. Many specimens yielded more than one organism, giving a total of 191 organisms in all. This rather high rate of isolation of bacteria is probably due to the type of patient we were investigating. Schoenfield[1] in 1971 quotes the very similar figure of 90% infection in this type of case.

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The results of culture are shown in Table I. It is notable that *Klebsiella, Proteus,* and *Pseudomonas* were isolated with greater frequency than would be found in acute cholecystitis, where the commoner faecal organisms such as *Escherichia coli* and *Streptococcus faecalis* predominate. The presence of the former organisms, as well as some particularly resistant strains of *E. coli,* leads to the problem of what is suitable antibiotic prophylaxis to cover these operations.

TABLE I

ORGANISMS ISOLATED FROM BILE TAKEN AT OPERATION
(100 PATIENTS; 142 OPERATIONS)

Escherichia coli	75
Klebsiella	44
Proteus	24
Pseudomonas	11
Faecal streptococci	18
Other streptococci	12
Clostridium welchii	2
Staphylococcus pyogenes ...	2
Other	3
Total	191

The infection of the biliary tree itself can be treated only by establishing proper drainage; the bile will not be sterilized by giving antibiotics alone. However, we wish to give prophylactic antibiotics to try to prevent fulminating local Gram-negative sepsis or septicaemia, both serious complications in these patients. The choice of initial postoperative antibiotics is an 'informed guess'. It depends on previous experience of the overall sensitivity of the organisms found in this sort of patient. Once the results of cultures on the patient's own bile are available the antibiotics must be reviewed and altered if necessary—for example, isolation of *Pseudomonas* will usually necessitate alteration.

However, in the meantime, what is our best bet as prophylaxis? We have constructed a 'league table' (Table II) for all the antibiotics we tested, from the results obtained on our own isolates. Not all antibiotics have been tested against every bacterium, some being tested only against cocci, while others were tested only against bacteria found to be unusually resistant to the standard antibiotics. Erythromycin, for example, was tested only against Gram-positive cocci and gentamicin against resistant organisms. These results are taken from routine testing, not special investigations. Notice how well up in the table are gentamicin, kanamycin, chloramphenicol, and cephalothin and how far down are ampicillin and tetracycline—the many resistant organisms being survivors from previous therapy.

TABLE II

ACTIVITY OF ANTIBIOTICS AGAINST ORGANISMS ISOLATED FROM BILE TAKEN AT OPERATION

	%	
Erythromycin	100	(31/31)
Gentamicin	91.6	(22/24)
Colistin	85.6	(107/125)
Chloramphenicol	85.5	(147/172)
Kanamycin	82.6	(128/155)
Cephalothin	73.7	(112/152)
Streptomycin	65.8	(125/190)
Cephaloridine	62.4	(98/157)
Carbenicillin	59.2	(16/27)
Sulphonamide	57.3	(90/157)
Tetracycline	50.2	(96/191)
Ampicillin	44.4	(77/173)
Penicillin	42.8	(12/28)
Cloxacillin	42.8	(12/28)
Rifamide	28.1	(9/32)

We also made tables of the activity of antibiotics against *E. coli* (Table III) and *Klebsiella* (Table IV) separately. These show little difference from one to the other—note gentamicin and kanamycin at the top. Although gentamicin was tested only against the most resistant organisms it would still retain its high place even if tested against all organisms. Rifamide, at the foot of the table, looks a poor bet, but the sensitivity discs used were standard strength—only 10 μg—and in practice Bevan and Williams[2] have reported quite good results in biliary surgery which they attribute to high rifamide levels in the bile.

Our own choice of prophylactic antibiotic has changed over the years with the change in the sensitivity of the organisms isolated at operation. Although at first sight antibiotics such as novobiocin and ampicillin, which are concentrated in bile, would appear to be useful, various workers, including Dr. Douglas White in our own department,

TABLE III

ACTIVITY OF ANTIBIOTICS AGAINST STRAINS OF ESCHERICHIA COLI ISOLATED FROM BILE TAKEN AT OPERATION

	%	
Gentamicin	100	(7/7)
Kanamycin	96.7	(60/62)
Colistin	94.6	(53/56)
Chloramphenicol	88.0	(59/67)
Cephalothin	82.0	(50/61)
Cephaloridine	80.3	(49/61)
Streptomycin	80.0	(60/75)
Sulphonamide	63.5	(45/71)
Tetracycline	53.3	(40/75)
Carbenicillin	45.4	(5/11)
Ampicillin	43.0	(31/72)
Rifamide	41.1	(7/17)

have found that the levels achieved in the bile of patients with chronic biliary disease are not high and that concentration is no longer taking place. For the prevention of septicaemia it is probably more important to achieve good antibiotic levels in the blood and surrounding tissues. With this in view we have recently used kanamycin and cloxacillin. Kanamycin is the most convenient antibiotic for Gram-negative rods (gentamicin would probably require considerably more laboratory monitoring). Cloxacillin has been used to cope with more superficial staphylococcal infections (i.e., in the wound) which are sometimes brought in by these patients, although not a very great problem at St. George's Hospital. It should be emphasized again, however, that it is important to check the sensitivity of the patient's own organisms when this becomes available (usually within 36 hours of operation).

TABLE IV

ACTIVITY OF ANTIBIOTICS AGAINST STRAINS OF KLEBSIELLA ISOLATED FROM BILE TAKEN AT OPERATION

	%	
Gentamicin	100	(5/5)
Colistin	91.7	(33/36)
Kanamycin	89.7	(35/39)
Cephalothin	86.4	(32/37)
Cephaloridine	78.4	(29/37)
Chloramphenicol	77.0	(30/39)
Streptomycin	69.7	(30/43)
Tetracycline	65.9	(29/44)
Carbenicillin	33.3	(2/6)
Ampicillin	6.9	(3/43)
Rifamide	0.0	(0/9)

In the future we expect to make further modifications of our system of prophylaxis. As we continue our 'rolling assessment' of bacterial sensitivities, we are considering replacing cloxacillin, possibly by a cephalosporin, and we are investigating the possible use of rifamide in our patients. The organisms' sensitivities so far tested by us agree with those found by Bevan and Williams, but we are not yet sure if adequate bile levels are in fact achieved in those patients who have particularly severe damage to the biliary tree.

REFERENCES

1. SCHOENFIELD, L. J. (1971) *New Engl. J. Med.*, **284**, 1213.
2. BEVAN, P. G., and WILLIAMS, J. D. (1971) *Brit. Med. J.* 3, 284.