THE USE OF ANTIBIOTICS IN ACUTE URINARY INFECTIONS*

J. W. J. VAN RENSBURG, M.B., CH.B. (CAPE TOWN), *Bloemfontein*

The use of antibiotics in acute urinary infections has become an essential part of therapy today. In no other field of medical practice has the abuse of antibiotics, however, become so evident. Among the reasons for frequent failure given by Womersley[1] are antibiotic-resistant organisms, failure to correct or recognize obstructive lesions in the renal tract, and difficulty in recognizing whether infection is present at all, or whether infection has been completely eradicated in a known infected case.

In attempting to clarify this complex clinical problem, I propose to consider its three essential components, i.e.:

1. The patient.
2. The organism.
3. The antibiotic.

THE PATIENT

Studies by Kass[2] and other workers have shown that pregnant women are particularly liable to asymptomatic bacteriuria which can result in frank pyelonephritis, hypertension and possibly premature delivery. The patient is generally considered to have a urinary infection if he has a bacteriuria which gives rise to a count of over 100,000 bacteria/ml. on a midstream culture of urine.

As quantitative bacteriological investigations are expensive and not always available in general practice, other screening methods have been devised. The application of these methods is dependent on the availability of techniques and the experience and particular abilities of the practitioner. It has been found that the success of various screening methods varies in different hands. These methods include semiquantitative bacteriological methods, chemical screening, e.g. TTC test, stain techniques and evaluation of pyuria.

A high percentage of urinary infections are complicated urological problems. These include anatomical abnormalities, mixed infections or resistant strains. This applies particularly to children, where congenital abnormalities occur, and men with obstructive lesions. These cases always require further urological investigations, e.g. intravenous pyelogram, micturating cystogram and cystoscopy, as surgical manoeuvres are frequently the only mode of treatment.

Clinically, a search should be made for diabetes, the chronic abuse of analgesics and conditions capable of producing disturbances of bladder innervation. Determination of blood urea and other renal function tests are important in avoiding harmful chemotherapy and unsatisfactory pyelograms.

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THE ORGANISM

For the purposes of this paper I have selected 500 cases of positive urine cultures done by the SAIMR in Bloemfontein during 1967. To exclude growths of possible contaminants, only cases of fresh urine specimens collected in Bloemfontein itself were selected. Only growths of 50,000 bacteria/ml. and more have been considered. The incidence of bacterial cultures in this series is shown in Table I.

TABLE I. BACTERIAL CULTURES OF 500 POSITIVE URINE SPECIMENS

Organism	*No. of cases*	*% incidence*
B. coli	249	50
Proteus mirabilis	84	19
Other proteus	12	
Aerobacter	47	10
Streptococci	23	5
Staphylococci	21	4
E. freundii	18	3
Paracolons	16	3
Kleb. pneumoniae	13	2
Pseudo-pyocyaneus	9	2
Others	8	2

The incidence of bacterial growths in Bloemfontein in 1967 correlates well with series elsewhere.[3-6]

THE ANTIBIOTIC

In the 500 cultures done by the SAIMR in Bloemfontein in 1967, sensitivity was measured to the following antibiotics (Table II):

TABLE II. SENSITIVITY OF THE URINARY PATHOGENS TO ANTIBIOTICS

	No. of cultures	Genta-micin	Winto-mylon	Peni-cillin	Strepto-mycin	Sul-phon.	Tetrac.	Clor-amph.	Ery-throm.	Neo-mycin	Novo-biocin	Kana-mycin	Nitrof.	Novodic tetrac.	Colis-tin	Ampi-cillin	Cloxa-cillin	Poly-mycin
B. coli	249	243	202	16	68	18	98	120	6	135	37	185	221	150	20	5	5	210
		6	**47**	**233**	**181**	**231**	**151**	**129**	**143**	**114**	**212**	**64**	**28**	**99**	**0**	**244**	**244**	**39**
Proteus spp.	96	92	78	22	27	4	8	66	1	21	41	72	69	73	0	1	1	23
		3	**18**	**74**	**69**	**92**	**88**	**30**	**95**	**75**	**55**	**24**	**27**	**23**	**9**	**95**	**95**	**73**
Aerobacter	47	47	33	1	6	3	22	14	2	21	9	31	33	31	4	0	0	37
		0	**14**	**46**	**41**	**44**	**25**	**33**	**45**	**26**	**38**	**16**	**14**	**16**	**0**	**47**	**47**	**10**
Streptococci	23	21	—	2	13	7	17	19	16	5	19	11	—	23	—	7	8	—
		2	—	**21**	**10**	**16**	**6**	**4**	**7**	**18**	**4**	**12**	—	**0**	—	**16**	**15**	—
Staphylococci	21	21	—	6	12	3	13	14	12	13	19	15	2	19	—	11	5	1
		0	—	**15**	**9**	**18**	**8**	**7**	**9**	**8**	**2**	**6**	**0**	**2**	—	**10**	**16**	**0**
E. freundii	18	18	13	2	3	1	5	9	0	11	1	12	16	7	4	0	0	16
		0	**5**	**16**	**15**	**17**	**13**	**9**	**18**	**7**	**17**	**6**	**2**	**11**	**0**	**18**	**18**	**2**
Kleb. pneumoniae	13	12	10	0	3	0	5	8	0	9	0	9	11	3	—	0	1	10
		1	**3**	**13**	**10**	**13**	**8**	**5**	**13**	**14**	**13**	**4**	**2**	**10**	—	**13**	**12**	**3**
Paracolon	16	16	13	3	4	0	9	8	1	8	1	14	13	8	—	0	1	15
		0	**3**	**13**	**12**	**16**	**7**	**8**	**15**	**8**	**15**	**2**	**3**	**8**	—	**16**	**15**	**1**
Pseudo-pyocyaneus	9	9	0	0	1	2	0	1	0	0	0	0	0	1	—	0	0	6
		0	**9**	**9**	**8**	**7**	**9**	**8**	**9**	**9**	**9**	**9**	**9**	**8**	—	**9**	**9**	**3**
Others	8	5	4	2	3	0	4	5	2	5	2	6	3	6	—	1	2	4
		3	**4**	**6**	**5**	**8**	**4**	**3**	**6**	**3**	**6**	**2**	**5**	**2**	—	**7**	**6**	**4**

The numbers of resistant strains are printed in bold type

The efficacy of some of these antibiotics (*in vitro*) is expressed in Table III.

TABLE III. % SENSITIVITY OF BACTERIA TO ANTIBIOTICS

	Nitrof.	Chlor-amph.	Strepto-mycin	Tetra-cycline	Ampi-cillin	Genta-micin	Winto-mylon
B. coli	88	48	27	19	2	97	81
Proteus spp.	72	69	28	9	1	96	81
Aerobacter	70	30	13	47	0	100	70
Streptococci	—	83	57	74	30	91	—
Staphylococci	9·5	67	57	62	52	100	—
E. freundii	89	50	17	28	0	100	72
Kleb. pneumoniae	85	62	23	39	0	92	76
Paracolon	81	50	25	56	0	100	81
Pseudo-pyocyaneus	0	11	11	0	0	100	0
Others	37·5	62·5	37·5	50	11·5	62·5	50

Comparative Studies

Thatcher and Forder reported a series done at the University of Cape Town during 1964, 1965 and 1966.[6] By comparison the Bloemfontein series of 1967 shows a much higher number of resistant strains or organisms. There does not appear to be any standardized concentration of antibiotic in discs used for sensitivity tests in different laboratories. This may to some degree explain discrepancies at different centres.

The high incidence of resistance *in vitro* to ampicillin in this series is particularly alarming, considering the high rate of sensitivity reported initially.[7] Vinnicombe[8] and Bush *et al.*[9] have noticed this phenomenon and Thatcher[6] drew attention to the decline of sensitivity of coliforms to ampicillin, nitrofurantoin and chloramphenicol in the short space of 2 years (1964 - 1966).

The series done by the SAIMR in Bloemfontein reports sensitivities to gentamicin and Wintomylon, which was not shown in the series by Thatcher and Forder. Unfortunately, only a few cases were tested and shown here with Colistin. Meiring,[10] in Pietermaritzburg, reports nearly 100% sensitivity with cephaloridine (Ceporan), which is also not reported in this series.

DISCUSSION

The problem which faces the practitioner when presented with an uncomplicated proved urinary infection is what antibiotic to use and for what duration? Sensitivity tests *in vitro* have shown the changing face of the antibiotic spectrum. The old standbys, namely the sulphonamides, are slowly falling by the wayside. Newer and sometimes more toxic drugs have taken their place. It would appear that some of these will not stand the test of time.

The physician will have to rely on basic principles in treating his case on clinical grounds, and must be merely aided by the laboratory. He will have to be well informed about recent changes in antibiotics, their toxicities and their dosage. Brumfitt[11] stressed the importance of obtaining tissue levels which exceed the minimum inhibitory concentration for the infecting organism by illustrating that intramuscular use of ampicillin was more successful than oral therapy.

When deciding on the duration of treatment with the suitable antibiotic it must be remembered that a urine is only sterile when this has been proved bacteriologically.

Bacterial sensitivity to various antibiotics will have to be reviewed constantly, to ascertain the tendencies in the changing spectrum. In this regard it is most important that antibiotic concentration on testing discs should be standardized throughout the world.

SUMMARY

Cultures of acute urinary tract infections done by the SAIMR in Bloemfontein during 1967 have been reviewed. The sensitivity of the bacteria to various antibiotics *in vitro* has been scheduled and related to results of workers elsewhere.

The problem of antibiotic treatment of acute urinary infection is discussed under its 3 basic headings, viz. the patient, the bacteria and the antibiotic. In the final reckoning, however, it will be the bacteria which have the last say.

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