Presentation, bacteriological diagnosis and test of cure of urinary tract infection in general practice—Report of a trial

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IN the last decade there have been papers from practitioners in the United Kingdom (Fry *et al.*, 1962; Loudon and Greenhalgh, 1962; Mond *et al.*, 1965), in New Zealand (Gallagher *et al.*, 1965) and in Denmark (Steensberg *et al.*, 1969) outlining the presentation, diagnosis and treatment of urinary infection in general practice. In addition there have been two statistical surveys (The Danish National Morbidity Survey, 1960; Logan and Cushion, 1958) which provide a general picture of urinary disease in Western communities.

Between one and two per cent of all consultations in general practice arise from urinary tract infections, and yet this may represent only half the problem, for many patients with symptoms from the urinary tract do not seek medical advice. Of those who do, only about half have bacteriuria. Mond and Gallagher and their associates have compared the clinical findings in symptomatic patients with bacteriuria with the findings in patients whose urine has no significant bacteriuria, and have noted little difference between the groups, save that there was a smaller proportion of patients with haematuria or pyrexia in the non-bacteriuric group.

Gallagher *et al.* (1965) showed that 28 per cent of the latter group developed bacteriuria if followed up for three months, and they were convinced that they suffered from the ' urethral syndrome ' which they considered to be the infection of the urethra and the surrounding glands. However Murdoch *et al.* (1968) found that a third of their 3,000 patients with urinary symptoms did not have, and did not develop, bacteriuria, and in these patients at least, the cause of the symptoms has yet to be found.

In this trial the clinical and bacteriological details of 530 patients whose specimens of urine were submitted for bacteriological analysis are examined. The age and sex distribution of the cases, the presenting features and their significance, the strains of bacteria isolated and their antibiotic sensitivity, and the effect of treatment on the patient's bacteriuria and symptomatology are recorded and discussed, and the importance of a test of cure is demonstrated.

Method

Six practices in the city and county of Aberdeen co-operated in the trial, the main details of which were as follows:

(1) Patients presenting with symptoms of urinary tract infection were included in the trial. No attempt was made to limit the study to a defined population, nor was it possible to include every patient with symptoms.

(2) The clinical diagnosis was checked with ' stream-inoculum outfit '. This consists of a plastic agar-filled spoon which is contained in a one ounce jar (Mackey and Sandys, 1965) and which is inoculated by passing the spoon through the uninterrupted

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stream of urine (Hulbert, 1972). The spoon is then returned to its container and sent to the laboratory by post.

During the third and seventh weeks after treatment had begun, further outfits were posted direct to the patients, for inoculation and return. With the first of these was a brief questionnaire asking whether the symptoms had been relieved by treatment.

(3) Treatment began immediately after the first specimen was obtained (and before the laboratory results were available) and was continued for 10–14 days. There was no significant difference in the effect of the various drugs used.

(4) The patient's age, sex, marital status, presenting signs and symptoms and history of past infections were recorded by the general practitioner.

(5) The organisms were identified in the laboratory, and disk-diffusion sensitivity tests were carried out using Oxoid filter-paper disks. The medium used was suitable for testing the sensitivity of bacteria to sulphonamides.

Results

The patients

The age and sex distribution, and the incidence of bacteriuria at consultation are shown in table 1. Of the 530 patients, 75 were male and 455 (86 per cent) were female. In 231 cases the viable count was over 10^5 bacteria per ml. Twenty-seven patients had viable counts of between 10^4 and 10^5 bacteria per ml. In practice, a decision on the significance of each of these specimens would be taken individually (with hindsight) in the light of the clinical features, further specimens if possible, and other factors. In this survey because the method of collecting the specimen eliminates much contamination these were all considered to be significant bacteriuria.

TABLE 1

AGE AND SEX DISTRIBUTION OF THE PATIENTS AND THE NUMBER IN EACH GROUP WITH SIGNIFICANT BACTERIURIA AT CONSULTATION

Age group	*Males*		*Females*	
	Number in each age group	*Number (and %) with bacteriuria*	*Number in each age group*	*Number (and) % with bacteriuria*
0–5	11	6 (*55*)	26	15 (*58*)
6–15	8	0	21	10 (*48*)
16–25	8	2 (*25*)	132	71 (*53*)
26–35	7	0	69	27 (*39*)
36–45	4	0	60	23 (*38*)
46–55	6	0	48	33 (*69*)
56–65	15	5 (*33*)	54	36 (*67*)
66–75	7	3 (*43*)	32	18 (*56*)
76–85	7	4 (*57*)	9	5 (*56*)
Not known	2	0	4	0
Total	75	20 (*27*)	455	238 (*52*)

Kass's influential report (Kass, 1956) shows that more than 50 per cent of asymptomatic women with over 10^4 bacteria per ml were eventually diagnosed as having ' pyelonephritis ', and the work of Effersoe and Jensen (1963) confirmed " with high statistical significance " ($p = \cdot 001-3$) that contamination can, at most, give a colony count of 10^4 bacteria per ml.

In this survey, among the males, about half the children up to five-years old had bacteriuria, a negligible proportion of the 6–55-year olds, and an increasing proportion, as age advanced, thereafter. Among the females, more than a quarter of all patients

were aged between 16 and 25, and a further quarter between 26 and 45. On average 52 per cent of females had bacteriuria, and overall the proportion was 49 per cent (258 cases).

Bacteriology

The bacteriological findings are illustrated in table 2. They show clearly the different composition of the two groups of bacteria which cause urinary infection. Strains causing a first infection were usually strains of *Escherichia coli* or *Proteus* (81 per cent), and the very great majority of these were sensitive to all the antibiotics tested (with the exception of tetracycline for strains of *Proteus*).

TABLE 2
THE IDENTITY AND DRUG SENSITIVITY BY DISK DIFFUSION OF 502 STRAINS OF BACTERIA

Species or group of bacteria	*'First' or 'recurrent' infection*	*Number of strains (and % of total in each group)*	*The proportion (%) of strains resistant to*					
			Ampicillin	*Tetracycline*	*Sulphonamide*	*Nalidixic acid*	*Nitrofurantoin*	*Kanamycin*
All strains	First	186 (*100*)	*91*	*81*	*73*	*95*	*94*	*95*
	Persistent	316 (*100*)	*77*	*67*	*62*	*89*	*91*	*91*
E.coli	First	128 (*69*)	*95*	*91*	*76*	*98*	*98*	*97*
	Persistent	177 (*56*)	*76*	*74*	*66*	*97*	*97*	*95*
Other coliform bacilli	First	14 (*7*)	*72*	*79*	*72*	*100*	*79*	*94*
	Persistent	32 (*10*)	*69*	*87*	*78*	*95*	*95*	*95*
Proteus	First	22 (*12*)	*95*	*23*	*77*	*91*	*91*	*95*
	Persistent	35 (*11*)	*74*	*14*	*51*	*91*	*83*	*94*
Other non-lactose fermenting bacilli	First	17 (*9*)	*71*	*88*	*71*	*94*	*88*	*100*
	Persistent	43 (*14*)	*76*	*72*	*65*	*82*	*74*	*88*
Gram-positive cocci	First	5 (*3*)	*100*	*80*	*0*	*20*	*80*	*60*
	Persistent	29 (*9*)	*97*	*55*	*28*	*38*	*80*	*59*

Notes 1. All isolates taken from patients after treatment are included in the ' persistent ' infection group.
2. The quantity of each drug in its appropriate disk was: ampicillin 25 μg; tetracycline 50 μg; sulphonamide 500 μg of sulphafurazole; nalidixic acid 30 μg; nitrofurantoin 200 μg; kanamycin 30 μg.

Strains causing a recurrent infection were less likely to be strains of *E.coli* and were more commonly strains of Gram-positive cocci or one of the less frequently isolated strains of Gram-negative bacilli. There were, however, no strains of *Pseudomonas aeruginosa* isolated. A larger proportion of strains from this second group were resistant to the drugs commonly used in general practice—ampicillin, sulphonamides and tetracycline. The difference in drug sensitivity between the two groups was most noticeable among strains of *E.coli* and *Proteus*, especially when sensitivity to these ' first line ' drugs was compared.

Symptomatology

An analysis of the main presenting symptoms and signs is shown in table 3, and the frequency with which each symptom was associated with bacteriuria is noted. Polyuria (including nocturia), dysuria, a history of previous infection, and pain were the common features of the disease, with overt haematuria, urgency, and pyrexia much less common.

The analysis was made separately for each group, but only the under-sixes differed significantly from the majority, and so the figures for this group are also shown. With

TABLE 3

RELATION OF SYMPTOMS AND SIGNS OF URINARY TRACT INFECTION TO THE PRESENCE OF SIGNIFICANT BACTERIURIA

Symptom or sign	*Total number of times recorded*	*Proportion (%) of times associated with infected urine*	*Number of times (and % with infected urine) among 37 children under 6 years of age*
Frequency of micturition	307	*51*	11 (*91*)
Dysuria	294	*55*	11 (*57*)
History of previous infection	134	*70*	8 (*88*)
Loin, suprapubic, back or abdominal pain	129	*32*	—
Haematuria	39	*64*	—
Pregnancy	26	*54*	—
Urgency	24	*50*	—
Pyrexia	13	*31*	5 (*20*)
Wetting	17	*53*	10 (*70*)

the exception of haematuria and a history of previous infection (and in the 0–5 age group, frequency of micturition and wetting) none of the symptoms was of much value in distinguishing those with bacteriuria from those without.

Effect of treatment on symptoms

Of the patients whose initial specimen of urine was infected and who completed treatment, 157 answered the question " Has the treatment made you better?" which was submitted with the first follow-up stream-inoculum outfit. The answers are analysed in table 4. It is clear that among these patients there was no correlation between a subjective ' cure ' and a bacteriological one, and that treatment frequently converted a symptomatic infection into an asymptomatic one, or at least relieved the more severe symptoms. On the other hand persisting symptoms, though infrequent, indicated continuing infection quite reliably.

TABLE 4

A CORRELATION OF THE SUBJECTIVE AND BACTERIOLOGICAL RESULTS OF TREATMENT OF 157 PATIENTS WITH INFECTED URINE

Subjective opinion of the patient	*Number of patients*	*Bacteriological result*	
		'Cure'	*'Failure'*
' Cure '	134	74	60
' Failure '	23	2	21

Discussion

The overall proportion of strains that were *E.coli* (62 per cent) is similar to that noted by others. The division of the strains into two groups is quite clear, with those strains that caused a first infection being predominantly (69 per cent) strains of *E.coli*, the great majority of which were sensitive to a wide range of drugs, whereas only 56 per cent of strains causing a further infection were strains of this species, and a substantial proportion of these were resistant to the commonly used antibiotics. The proportion of strains of *E.coli* in this latter group, however, was not as low as 43 per cent which was the figure recorded by Garrod *et al.* (1954) in their study of urinary infection among hospital patients.

The existence of two groups of patients, those with bacteriuria and those without, is confirmed, as is the difficulty in deciding clinically to which group a patient belongs.

However some factors have emerged which may aid the diagnosis. Among the males the two groups differed in their age structure, those with bacteriuria being concentrated in the under sixes and over 55s. Also there were differences in the symptomatology. Gallagher *et al.* (1965) and Mond *et al.* (1956) have noted that bacteriuria was related more closely to haematuria and pyrexia than to other symptoms. In this trial pyrexia was not more common in patients with bacteriuria, but haematuria was, as was a history of previous infection, and in the under six-year olds, wetting and frequency.

The test of cure is shown to be an essential part of the management of patients with urinary infection. The patient's subjective opinion about the effect of treatment is only reliable when he or she considers that it has failed.

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