Setback

On 27 November 1975 I went for an early morning walk using only one stick. I lurched, caught my foot in a grating, and fell. I thought I had bruised myself, but when I got indoors I found that I could not get upstairs. A radiograph showed an intertrochanteric fracture of the left femur, and I was again admitted to hospital, where the orthopaedic surgeon inserted a pin and plate, and after three days I returned to the local hospital. I continued physiotherapy and had to walk entirely on crutches for three weeks. On 20 December, after I had begun walking again, I returned home and I started work on 5 January 1976.

Postscript

Now, over two years after the onset, my balance and walking are much improved and walking with a stick is "almost normal." My hands remain weak and wasted but steadier.

Sensation remains severely distorted and impaired. Positional sense is almost normal and I can even find notes on the piano without looking. Paraesthesiae of both hands is continuous and makes fine touch difficult, although gross touch is now better. The soles of my feet remain extremely sensitive and stepping even on the edge of the bath mat feels like treading on a steel wire. Perhaps the most unpleasant disturbance, however, is temperature sensation. For a time I lost all sense of temperature and would complain of feeling cold when others

felt warm. This happens rarely now but I do have odd and changeable feelings, both subjective and objective, of cold in my fingers and feet. Subjectively the coldness is so intense as to be painful. Difficulty in starting or finishing micturition is still sometimes a problem. I can drive without difficulty.

I still waken in the early morning with pain in my legs, especially the knees and calves, and these pains will often come on at other times, usually towards evening. Sitting for long in any one chair is uncomfortable and with wasted muscles I have to have adequate cushions on most chairs. Another extremely unpleasant pain which occurs intermittently is a feeling that the os calcis or the big toe is being squeezed in a vice.

Residual symptoms occur in some patients who have suffered the Guillain-Barré syndrome—usually in those who showed little or no progress in the first two to three weeks. I often wonder whether my colleagues are being unduly optimistic about my ultimate full recovery, but time alone will tell.

Bibliography

- British Medical Journal*, 1975, **3**, 190.
Gautier-Smith, P C, *Brain*, 1965, **323**, 334.
Haymaker, W, and Kernchan, J W, *Medicine*, 1949, **59**, 141.
Recent Advances in Clinical Neurology, vol 1, ed W B Matthews. Edinburgh, Churchill Livingstone, 1975.
Thomas, P K, *Medicine*, (London), 1972-4, **33** (3), 1944.

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Today's Treatment

Diseases of the urinary system

Urinary tract infections

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Over the past 40 years numerous antibacterial agents effective in the treatment of urinary tract infections (UTI) have been introduced yet morbidity from these common non-obstructive infections continues to be a major problem. Up to 59 per 1000 consultations in general practice are for symptoms suggesting UTI. The founding of lay organisations that seek a better deal for sufferers illustrates our therapeutic shortcomings. Factors that contribute to the continuing morbidity include our inability to eradicate the source of urinary pathogens; the existence of a large reservoir of covert infections in the healthy population; the frequency of recurrent infection after treatment, and, the most taxing problem of all, the occurrence of symptoms similar to those of UTI in the absence of infection—a problem that falls outside the scope of this article.

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Prophylaxis

The commonest source of urinary pathogens is the bowel flora, and the organisms that cause UTI do not possess special pathogenicity. Therefore eradication of the source of UTI requires elimination of the normal bowel flora. This is not feasible on a long-term basis. Prophylaxis by preventing the entry of micro-organisms into the urinary tract holds out greater promise. The value of aseptic precautions during instrumentation of the urinary tract and closed catheter drainage is now common knowledge. Since colonisation of the introitus in the female and subprepuccial space in the male precedes UTI, improvement of perineal hygiene or local use of antibacterial agents, or both, might be expected to prevent infection. So far there have been no controlled studies to establish the value of such measures.

Quantitative urine culture enabled the identification of covert infections in apparently healthy populations. These infections are common (table 1), and they predispose to symptomatic infection. Screening for covert infections might therefore be expected to reduce morbidity from UTI. This is certainly so in pregnancy. Some 30% of pregnant women with covert bacteriuria develop acute pyelonephritis and eradication of the bacteriuria in early pregnancy can prevent this. In non-

pregnant women and in children screening for covert infection has no preventive value because short courses of treatment that might be used on a large scale are followed by recurrent infections. When such recurrences are due to a different organism from that originally isolated they are more likely to be associated with a bout of symptomatic infection than if the original covert infection had been left untreated. Screening for covert infections in population groups other than pregnant women could be justified only if it were shown that the condition leads to progressive kidney damage, which could be prevented by treatment of the bacteriuria. Controlled studies of the natural history and response to treatment of covert infections have not so far yielded any evidence to this effect.

TABLE 1—Prevalence of significant bacteriuria

Population	Age (years)	Prevalence (%)
Adult women	21-64	5
Pregnant women	16-40	3-5
Schoolgirls	5-12	2
Preschool children	0-5	0.8 (girls) 0.2 (boys)
Adult men	21-65	0.5
Schoolboys	5-12	0.3
Neonates	0-1 month	1-2 (mainly boys)

When and how to investigate UTI

Before treating symptomatic infection a freshly voided "clean-catch" urine specimen should be examined under the microscope, and if possible a Gram-stained film of urine should also be prepared. Symptomatic infections seldom occur in the absence of pyuria and never in the absence of bacteriuria. Both of these may readily be detected by urine microscopy. The volume of urine seen in one field with a "high-dry" objective (magnification $\times 570$) is about 1/30 000 ml. Therefore at least 3×10^4 bacteria per ml of urine must be present before one may expect to see bacteria on microscopy. In most infections this number is exceeded by far, and organisms may therefore readily be detected.

The urine should also be sent for culture and sensitivity testing. It must be plated within two hours of voiding or cooled to 4°C in the interim. Preferably a dip-inoculum transport medium should be inoculated to do away with the need for rapid transport of urine specimens to the laboratory.

Even after only one proved attack of UTI children should be referred for excretion urography. Equally, boys and men of all ages should be so examined to exclude obstructive lesions. In the adult woman excretion urography need be undertaken only when repeated infections occur that are not linked to sexual intercourse. It is particularly important to perform excretion urography in women who suffer from repeated attacks of pyelonephritis confined to one side. At all times it must be remembered that tuberculosis of the urinary tract may present with repeated symptomatic UTI. The value of micturating cystography is undoubted where it concerns the investigation of possible urethral obstruction (such as urethral valves). The importance of detecting vesicoureteric reflux in children is still sub judice (see below).

Treatment of symptomatic infection

Drugs commonly used in treating symptomatic infections are listed in table II. Successful treatment needs adequate urinary concentration of an antibacterial agent to which the infecting organism is sensitive together with scrupulous follow-up. In domiciliary practice initial treatment irrespective of the drug used results in cure of infection in some 90% of patients. In hospital practice a lower success rate is found.

Unfortunately, initial cures are followed by recurrences. About 80% of patients treated for UTI develop recurrent infection within 18 months. Serotyping of urinary pathogens

TABLE II—Agents effective in treatment of UTI

Oral	Parenteral
Amoxycillin	Ampicillin
Ampicillin	Carbenicillin
Cephalexin (successfully used in low-dose, long-term prophylaxis)	Cephalothin
Co-trimoxazole (successfully used in low-dose, long-term prophylaxis)	Colistin
Cycloserine (successfully used in low-dose, long-term prophylaxis)	Penicillin G
Hippuric acid	
Mandelamine (successfully used in low-dose, long-term prophylaxis)	
Nalidixic acid (successfully used in low-dose, long-term prophylaxis)	
Nitrofurantoin (successfully used in low-dose, long-term prophylaxis)	
Penicillin V	
Pivampicillin	
Pivmecillinam	
Sulphonamides:	
Short acting (eg, sulphadimidine 8 tablets a day)	
Medium acting (eg, sulphamethoxy-pyrazine 1 tablet a day)	
Long acting (eg, sulphamethoxydiazine 1 tablet weekly)	

facilitated a more detailed analysis of these recurrences. Re-appearance of infection after treatment is of two distinct types—*relapse* and *reinfection*—with different temporal relations and different therapeutic implications. A recurrence of infection may be due to relapse—that is, infection with the same organism as that isolated before treatment. Most relapses occur within the first month after treatment is stopped, whereas most reinfections occur from one to six months after treatment. Whereas relapse indicates failure of treatment, reinfection indicates a defect of the host's defensive mechanism.

CAUSES AND MANAGEMENT OF RELAPSING INFECTION

In some patients the cause of relapsing infection can readily be identified and dealt with. The following are the major causes of such treatment failures.

Wrong choice of drug—Symptomatic infections usually have to be treated before the antibiotic sensitivity pattern of the infecting strain is known. Treatment is therefore based on the "best guess" principle. This guess should be made in consultation with the local bacteriologist who is familiar with the antibiotic sensitivity pattern of urinary pathogens encountered in the population from which the patient comes.

Emergence of resistant strains—During treatment resistance to the drug in use rarely develops. Resistant strains appear during treatment usually because a few of the organisms causing the infection were resistant from the start. In these cases the antibacterial agent exerts a selection pressure that favours the survival and multiplication of the resistant organisms by eliminating the sensitive ones. To overcome this cause of "relapsing" infection the doctor must change the antibacterial agent to one to which the "minority" organism is sensitive.

Inadequate duration of treatment—The duration of treatment does not affect the recurrence rate. The cure rate of bacteriuria in pregnant women treated for eight, 21, and 30 days is the same. Comparisons of the results from courses of treatment between two and six weeks and between one and two weeks showed no difference. In young girls with UTI no difference in recurrence rate after either a 10-day or a 60-day course of treatment has been found. So both toxicity and expense may be reduced by using short seven-day courses of treatment. Treatment of symptomatic infections usually relieves the symptoms within 24 to 48 hours. Consequently patients commonly fail to complete even a seven-day course of treatment. Possibly this practice leads to relapse. Recently, however, it has been shown that the results of three-day and 10-day treatment of UTI with amoxycillin did not differ greatly.

Inadequate concentration of antibacterial agent—Most antibacterial agents that are used to treat UTI are weak organic acids or bases. The renal handling of these includes glomerular

filtration, tubular secretion, and passive non-ionic back diffusion. Interaction of these processes determines both the clearance of antibacterial agents and their urinary concentration. With most of the commonly used antibacterial agents the urinary concentration is far above the minimal inhibitory concentration needed to exert a bactericidal or bacteriostatic effect on sensitive organisms. This may not be the case in impaired kidney function. Thus when a single loading dose of nalidixic acid is given to a patient with considerably reduced glomerular filtration rate, the urinary concentration of the drug is insufficient, and not until the drug has accumulated in the blood stream after several doses does the filtered load become high enough to achieve a therapeutic urinary concentration.

When impairment of kidney function affects only part of the total renal mass, as in the case of a patchy disease such as renal infection, drug accumulation in the blood stream does not occur because overall kidney function is relatively little impaired. Consequently, the concentration of antibacterial agents in the nephrons with impaired function remains low despite repeated administration of the drug. In kidney infections the drug may, therefore, bypass the bug. This is probably why it is more difficult to eradicate infection when the kidneys are affected. When relapsing infection is thought to be due to this cause, high-dose treatment with bactericidal drugs such as intravenous carbenicillin and intramuscular gentamicin is indicated; such treatment enables a sufficient concentration of the drug(s) to reach the site of infection. In rare cases when infection is localised to one kidney that contributes little to overall kidney function, nephrectomy may prevent symptomatic relapses.

L-forms—Both the natural defensive mechanisms acting through the antibody-complement-lysozyme system and the antibacterial agents acting by interfering with bacterial cell wall synthesis—namely, penicillins, cephalosporins, and cycloserine—produce osmotically fragile bacterial forms. These L-forms, named after the Lister Institute in London, normally fragment and die. The hypertonic conditions in the renal medulla favour their survival, and once treatment is stopped L-forms may reverse to their parent strain. In animals infection has been found to re-emerge owing to persistence of L-forms after treatment with penicillin, and bacterial variants have been shown in human urine under conditions of increased tonicity and antimicrobial treatment.

Relapses due to persistent L-forms may be treated by using chemotherapeutic agents that are active against cell wall defective organisms—for instance, erythromycin. Equally, lowering of medullary osmolality by increasing the fluid intake can prevent the formation of L-forms. It is not known how important a source of relapsing infection L-forms are. One report suggests they account for some 20% of all relapsing infections.

Urolithiasis—Urolithiasis is a common cause of relapsing infection. Urease splitting organisms can be isolated from the centre of infection stones. These organisms are protected from the action of antibacterial agents. Even after removal of the stones infection often recurs. This may be because microcalculi that contain organisms are left behind, and their removal by postoperative irrigation with chelating agents has been advocated.

Symptomatic relapses of unknown origin—Often the cause of symptomatic relapsing infection cannot be identified or if identified cannot be eliminated, as in the case of neurogenic bladder disturbance or when symptoms are precipitated by sexual intercourse. In these cases long-term suppressive treatment with antibacterial agents may be necessary to control symptoms. When symptoms are precipitated by intercourse a single dose of an antibacterial agent taken after intercourse together with the advice to empty the bladder at this time may suffice to control symptoms. With relapsing infections unrelated to intercourse a nightly dose of an antibacterial agent may produce relief. The rationale of this treatment is that the longest period between successive acts of micturition is overnight. The presence of an antibacterial agent in the urine at this time

will limit bacterial growth and so aid natural defences at a time when it is most needed.

In choosing antibacterial agents for long-term suppressive treatment it is important to use drugs that do not alter the antibiotic sensitivity pattern of the bowel flora. Drugs that are absorbed high up in the small bowel, such as nitrofurantoin (50 mg), are suitable. Alternatively, other drugs may be used in low dosage so that the antibacterial agent fails to reach the colon in sufficient concentration to affect the bowel flora for instance, cephalexin 125 or even 62.5 mg nightly. Organic acid treatment may also be used for long-term prophylaxis (for instance, hexamine mandelate) since bacterial resistance to these agents is unknown. One difficulty is that urinary pH must be kept below 5.8 so that mandelic acid is largely undissociated and can penetrate the bacterial wall and exert its cidal effect. It may be necessary to take large quantities of vitamin C or methionine to lower the urinary pH sufficiently. In the presence of infection due to urea splitting organisms or when kidney function is impaired it may be impossible to lower the urinary pH sufficiently.

Management of reinfections

Reinfections account for 80% of recurrent infections. They occur months rather than weeks after ending treatment and are attributable to a failure of the host defensive mechanisms. Because the intervals between successive attacks of symptomatic reinfection are longer than those between symptomatic relapses long-term suppressive treatment is seldom justified.

The management of symptomatic reinfections has been greatly simplified by the introduction of dip-inoculum transport media. Reinfections can now be dealt with by providing the patient with a week's supply of an antibacterial agent to which her organism is sensitive. The patient is thus advised to start herself on treatment at the first evidence of recurrence and to send an inoculated dipslide to the laboratory immediately before treatment begins. In this way symptoms are minimised while bacteriological supervision is maintained. The defensive mechanism can further be strengthened by advising a high fluid intake and by paying particular attention to complete bladder emptying.

Special problems

TREATMENT OF UTI IN PREGNANCY

Antibacterial agents that are safe in the non-pregnant woman may be contraindicated in pregnancy. Tetracycline is a particular example since discolouration of the child's teeth may follow its use in pregnancy. This phenomenon appears to be dose-related. If tetracyclines are to be used it is best to use oxytetracycline. Tetracyclines should never be given intravenously during pregnancy for fear of producing fatal liver necrosis. Sulphonamides should be avoided during the last trimester since they may precipitate or exacerbate kernicterus by displacing bile salts from their plasma protein binding sites. Nalidixic acid should also be avoided in the late stages since it may produce hydrocephalus even in low dosage.

TREATMENT OF UTI IN KIDNEY FAILURE

Particular problems that arise when attempting to treat UTI in the presence of end-stage kidney failure: infections are usually acquired in hospital and are thus more likely to be due to resistant organisms; therapeutic urinary concentrations of antibacterial agents may be difficult to attain without systemic toxicity; therapeutic urinary concentrations of antibacterial agents are more slowly established and drug resistance may therefore develop more readily during treatment; urinary acidification is not possible; and disparity of functional im-

pairment of the kidneys may lead to unequal excretion of antibacterial agents and persistence of infection in the kidney with the poorer function. In these patients the most useful drugs are probably the penicillins, co-trimoxazole, and gentamicin because adequate urinary concentrations of these drugs can be obtained without systemic toxicity. Thus in the case of co-trimoxazole both the sulphonamide and trimethoprim are excreted in sufficient concentration despite the presence of advanced kidney failure.

Two drugs must be avoided in treating UTI in the presence of kidney failure. Firstly, the tetracyclines must be avoided because, with the exception of doxycycline, they greatly aggravate kidney failure by producing a natriuresis that leads to salt depletion and prerenal renal failure further aggravated by the vomiting that the salt depletion may induce. Tetracycline also prevents urea utilisation by the liver and so produces an even greater rise of serum urea concentration. The second drug is nitrofurantoin since not only is it ineffective in renal failure but it may also produce a serious irreversible peripheral neuropathy.

TREATMENT OF PROSTATIC INFECTION

Bacterial infection of the prostate is an important source of recurrent UTI in men. It is difficult to eradicate because many

of the commonly used antibacterial agents fail to penetrate prostatic fluid and even if they do they may not be fully effective in the prostatic fluid that is highly acidic. Only the basic macrolides (erythromycin and oleandomycin), co-trimoxazole, tetracycline, and clindamycin are found in the prostatic fluid in concentrations high enough to suggest any therapeutic potential. Ampicillin, cephalothin, kanamycin, nalidixic acid, nitrofurantoin, oxytetracycline, penicillin G, polymyxin B, and some sulphonamides are either not excreted into the prostatic fluid or are present in such low concentrations as to be useless for treatment. The factors that govern the transport of antibacterial agents into the prostatic fluid include their degree of protein binding, their pKa value, and most importantly their lipid solubility.

PLACE OF SURGERY IN TREATMENT

The role of surgery in relieving obstructive lesions, removing stones, and removing an infected, poorly functioning kidney is not in doubt. Urethral dilatation is not of value in preventing recurrent UTI, and the value of ureteric reimplantation for vesicoureteric reflux is now being studied by controlled treatment trials in two cities in Britain. The results of these studies should be awaited before surgical treatment of vesicoureteric reflux is advised.

Contemporary Themes

Hospital inpatient provision for patients with dementia

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Elderly people suffer from a wide range of mental disorders. Among these, the dementias are particularly important because they produce great disability and are not yet reversible. Most demented people live at home with their families, and much can be done to support them by domiciliary services and forms of partial hospitalisation. Nevertheless, some elderly demented people are cared for in institutions and most would agree that this constitutes optimal care for some.

Residential care for demented old people is provided by statutory and voluntary bodies—mental hospitals, geriatric hospitals, Part III accommodation, and charitable institutions. The balance between services varies across Britain, owing more to historical accident and precedent than planning. Central planning of health care facilities is now to supplant the vagaries of local evolution. It is important to be sure that these plans allow for as adequate a service as those they seek to replace.

Proposals

Psychiatric hospitals are to provide 2.5-3.0 beds for every 1000 people aged 65 and over to accommodate severely demented patients, while local authorities are expected to cater for mildly demented people and geriatric hospitals for demented people when they are physically ill.¹ Clearly this ration of beds was derived from the estimate of beds occupied by demented patients in mental hospitals in 1971.² Details of the original survey³ are available, and the statistics and research division of the DHSS will provide further information. The range of provision for demented patients under psychiatric care was considerable in 1971, and eight of the 14 English regions fell outside the suggested range of 2.5-3.0 beds per 1000 people aged 65 or more (table I). Other sources⁴ quantify the distribution of "geriatric" beds throughout the country and show that they too are unevenly distributed (table II).

For some time it has been recognised that many old people in hospital because of their need for mental nursing are to be found in chronic sick or geriatric hospitals,⁵ and it is sometimes suggested that where there are active geriatric services the elderly need fewer psychiatric services.⁶ This may be so but in terms of bed provision region by region there is no consistently greater provision of geriatric facilities in areas where few beds in psychiatric hospitals are available to demented patients.

It is less easy to reflect local authority provision of residential care on a regional basis, yet this certainly complements and often supplements hospital services. In South Manchester in November 1975 21 beds were provided for elderly demented patients by psychiatric hospitals for a population of 193 000, of whom 28 000 were

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