INVESTIGATIONS

'Microstix'—a new diagnostic aid

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SUMMARY. The usefulness of 'Microstix' as a diagnostic tool in urinary tract infections in general practice has been evaluated. The nitrite component detected only 53 per cent of cases of significant bacteriuria, and gave rise to a nine per cent false positive result. The culture media correctly detected 93 per cent of cases of significant bacteriuria, but this was associated with a false positive result of nine per cent.

Introduction

GENERAL practice requires a cheap, speedy and reliable method to assist in the diagnosis of urinary tract infection. For, on the one hand, significant bacteriuria is present in the urine only in a relatively small proportion of instances where the patient complains of symptoms, traditionally caused by urinary infection. On the other hand, significant bacteriuria is often asymptomatic.

Over recent years, several methods have assisted general practitioners in the diagnosis of urinary tract infection. Open access to a regional pathology laboratory has meant that urine can be skilfully cultured and examined microscopically. Dip slides, consisting of agar slabs, can be immersed in urine and then incubated and cultured in the general practitioner's surgery. The 'Uriglox' test, which tests the urine for hypoglycosuria is convenient to use in a general practitioner's surgery, but may not be suitable for all patients. Urine can be tested for the presence of nitrites, which are metabolic by-products of bacterial metabolism, by means of simple strip tests such as 'N-Labstix'. 'Microstix', which shares the features of a conventional strip test and those of a dip slide, is a recent innovation.

The 'Microstix' reagent strip consists of a plastic strip with three reactive areas: a chemical test for the immediate recognition of nitrite in urine, and two culture areas for semiquantitative growth of bacteria.

The nitrite test depends upon the conversion of nitrates (derived from dietary metabolites) to nitrites by certain bacterial species. Nitrites in the urine react with p-arsanilic acid to form a diazonium compound, which in turn couples with N-(1-naphthyl)-ethylenediamine impregnated in the strip to form a pink colour.

The culture areas consist of a dry fibrous medium previously infused with extracts of bovine heart and brain, together with triphenyltetrazolium chloride. One of the culture areas is capable of supporting total bacterial growth. The other culture area contains sodium desoxycholate, an inhibitor, which prevents the growth of gram-positive organisms, thus selectively allowing the growth of gram-negative bacteria. Bacterial growth in these media converts triphenyltetrazolium to formazan, producing pink spots in the culture media.

The strip test is immersed in urine for five seconds, and then removed. After thirty seconds, the colour of the nitrite area is examined for the development of pink coloration. The strip is then placed in a transparent incubation pouch, and incubated at 35 to 37°C for 12 to 18 hours. The development of pink dots, formed by bacterial colonies, on the culture areas is then compared with standards on an accompanying chart. From the density of these pink dots, a semiquantitative estimate of bacterial concentrations in the urine can be made.

Method

During the period of the study, all patients suspected on clinical grounds of suffering from urinary tract infection were asked to provide an early morning midstream specimen of urine, within two hours of micturition, prior to the commencement of antimicrobial therapy. No genital toilet was requested. The criteria for inclusion in this study were the presence of the symptoms of dysuria, frequency of micturition, and nocturia, irrespective of the presence of other symptoms such as loin or suprapubic pain, pyrexia, haematuria, or cloudy or offensive urine.

Immediately upon receipt, the specimen of urine was divided into two aliquots. One aliquot was poured into a small plastic container, containing boric acid as a

bacteriostat, and sent by post to the regional laboratory for culture and microscopy.

The second aliquot was used for the 'Microstix' test. The nitrite test was read after thirty seconds, and the result recorded. The 'Microstix' strip was then incubated at 35°C for 12 to 18 hours, according to the manufacturer's instructions. The results were initially recorded on a proforma. They were then transferred to punched cards (Copeland-Chatterson Co. Ltd.), and later needle-sorted and analyzed.

Results

There were 57 discrete episodes in which patients presented with symptoms suggestive of urinary tract infection. When a specimen of midstream urine from these patients was cultured by the regional pathology laboratory, significant bacteriuria (i.e. $>10^5$ organisms per ml of urine) was found in only 15 instances (26 per cent). On microscopy, a further 16 specimens (28 per cent) contained an excessive number of pus cells, even though, on culture, the urine was either sterile or grew less than 10^5 organisms per ml (Table 1).

The 'Microstix' test was applied to the 15 urine specimens which grew significant bacteriuria on laboratory culture. The nitrite test detected significant bacteriuria in only 53 per cent of instances. However, all but one specimen grew a significant growth of bacteria on the 'Microstix' culture media. Growth on the medium for total bacterial count was identical to that on the medium for gram-negative bacteria only (Table 2).

Twenty-two of the initial 57 specimens (39 per cent) neither grew any bacteria when submitted to laboratory culture nor were found to contain an excess of pus cells on microscopy. When these 22 specimens were subjected to the 'Microstix' test, nitrite was found to be present in two specimens, which gave a false positive rate of 9 per cent. Seventeen specimens (77 per cent) grew no bacteria, but two specimens (9 per cent) inexplicably gave rise to a significant growth (Table 3).

Table 1. Results of laboratory culture and microscopy.

	Number	*Percentage*
Significant bacteriuria ($>10^5$ organisms per ml)	15	*26*
Excess pus cells on microscopy but $<10^5$ organisms per ml	16	*28*
$<10^5$ organisms per ml of urine, with no excess of pus cells	26	*46*

Table 2. Results of 'Microstix' test on urine which by laboratory culture grew significant bacteriuria.

	Number	*Percentage*
Nitrite present	8	*53*
Total count		
$>10^5$ organisms per ml	14	*93*
10^4-10^5 organisms per ml	0	*0*
$<10^4$ organisms per ml	1	*7*
Gram-negative count		
$>10^5$ organisms per ml	14	*93*
10^4-10^5 organisms per ml	0	*0*
$<10^4$ organisms per ml	1	*7*

Table 3. Results of 'Microstix' test on urine which contained no excess pus cells on microscopy, and which was sterile on laboratory culture.

	Number	*Percentage*
Nitrite present	2	*9*
Total count		
$>10^5$ organisms per ml	2	*9*
10^4-10^5 organisms per ml	3	*14*
$<10^4$ organisms per ml	17	*77*
Gram-negative count		
$>10^5$ organisms per ml	2	*9*
10^4-10^5 organisms per ml	3	*14*
$<10^4$ organisms per ml	17	*77*

Discussion

Following the classical work of Kass (1956), a urinary tract infection is said to exist when the concentration of bacteria in the urine exceeds 10^5 organisms per ml. However, the correlation between the presence of symptoms referable to the urinary tract and the presence of significant bacteriuria is poor (Tuxford, 1975). On the one hand, significant bacteriuria may be asymptomatic while, on the other hand, symptoms traditionally considered to be due to urinary infection may be accompanied by a sterile urine. The latter situation is sometimes termed the 'urethral syndrome'. In the present study, only 26 per cent of specimens had a bacterial concentration in excess of 10^5 organisms per ml. This compares with 38 per cent in a study by Hendry (1973), and 60 per cent (Charlton *et al.*, 1976).

A variety of methods is now available to assist the general practitioner. There is a good correlation between the results given by dip slides cultured by the general practitioner, and the results of laboratory culture; indeed the use of dip slides has been considered a satisfactory and speedier alternative (McAlister, 1974). The microscopy of centrifuged specimens of urine has been employed for many years for the

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diagnosis of urinary tract infection, although recent work (Finch and Finch, 1970) suggests that there is a poor correlation between microscopy findings and bacterial infection. Strip tests, such as 'Uriglox', which detect hypoglycosuria have been reviewed elsewhere (Collacott, 1977; Emmerson and Mond, 1973; Papanayiotou *et al.,* 1970). 'Uriglox' is unsuitable for use in diabetic patients.

'Microstix' combines the advantages of the speed of the nitrite test with the accuracy of a culture method. In the present study, the nitrite test detected 53 per cent of cases of bacterial infection, which compares favourably with the manufacturer's claim. There were, however, two false positive results (9 per cent). The results of urine culture using 'Microstix' were identical on both the 'total count' medium and the selective gram-negative medium. Using 'Microstix', 93 per cent of cases of significant bacteriuria were detected. Indeed, there was only a single false negative result. Similarly, when the laboratory results showed the urine to be sterile, 77 per cent of 'Microstix' cultures grew less than 10^4 bacteria per ml, while a further 14 per cent gave an equivocal result. There were only two false positive results (9 per cent).

There are no reports on the use of 'Microstix' in general practice. Gatenby *et al.* (1974) also showed 'Microstix' to be a sensitive indicator of urinary infection in hospital. They found that its culture area detected 100 per cent of bacterial infection, although the nitrite test area detected only 34 per cent. The total bacterial medium, however, gave a false positive result in 36 per cent of cases, while the gram-negative medium gave false positive results of 25 per cent. Mahoney (1974) found a detection rate of significant bacteriuria of 71 per cent but a false positive rate of nearly six per cent. Kunin (1975) found a detection rate of significant bacteriuria of 90 per cent.

The results of these studies appear promising. Further studies should therefore be undertaken within general practice to evaluate further this new diagnostic aid.

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