A simple strip test for the diagnosis of urinary tract infection in general practice

A. M. EMMERSON, B.Sc., M.R.C.Path.
Department of Bacteriology, University College Hospital, London

N. C. MOND, F.R.C.G.P.
London

The management of patients with symptoms referable to the urinary tract forms a substantial part of the workload of the doctor in general practice. Nevertheless, the ease of access to hospital laboratories varies markedly throughout the country. Not many general practitioners have the equipment, the time or the interest to do their own bacteriological investigations and other solutions have been sought.

Widespread use is being made of the various dip inoculum transport-media now available. These include Mackey and Sandys' Spoon (1965), the dip slide method, Guttmann and Naylor (1967), the ' Uricult ' dip slide (Arneil, McAllister and Kay, 1970; MacLean, McCallum and Davies, 1971), and the inculator method (Mabeck and Mabeck, 1970). Once these dip slides have been inoculated they may be incubated in the surgery, or can be sent by post to the laboratory. After this time, during which bacterial growth occurs, expert interpretation is desirable to determine whether any growth is pure or mixed.

Chemical methods for detecting significant bacteriuria such as the triphenyl tetrazolium chloride test (Simmons and Williams, 1962) or the Griess nitrite test (Sleigh, 1965) have been used with only partial success, since their accuracy is too low to justify their general use. It is possible with these tests to obtain a ' positive ' result from a contaminated specimen. There is, therefore, a place for a simple test which is able to differentiate between contamination and infection.

Normal uninfected urine contains a small but measurable amount of glucose (usually 2–20 mg/100 ml). This glucose is metabolised in the bladder urine by multiplying bacteria. Thus the urinary glucose concentration falls in urinary tract infection (UTI) in the same way that the glucose content of cerebrospinal fluid falls in acute bacterial meningitis.

' Uriglox ' is a simple biochemical strip test for the detection of hypoglucosuria which has been shown (Scherstén, Fritz and Kohler, 1969; Emmerson, 1972) to be a reliable indicator of the presence of significant bacteriuria. This report concerns the use of ' Uriglox ' to detect significant bacteriuria in symptomatic patients in general practice.

Method

We have previously decribed the symptomatology of patients with urinary tract infection seen in this practice (Mond, Percival, Williams and Brumfitt, 1965; Mond, Grüneberg and Smellie, 1970) and discussed their management.

Patients of all ages and both sexes attending the surgery complaining of symptoms suggestive of urinary infection were included. During four winter months 55 patients were investigated and 101 specimens were tested.

At the first appointment the patient was examined and a history taken by one of us (NCM). The nature of the study was explained to the patient who was then given a wide-mouthed 28 ml plastic container and a printed copy of the manufacturer's instructions on the method employed in the collection of an early morning fasting urine. The technique of collection of a mid stream ' clean catch ' specimen without prior vulval toilet was explained to the patient. The patient was then asked to collect a fasting urine the following morning (according to the manufacturer's instructions) and to keep it cold until it could be delivered to the surgery, usually within two hours. The patients who were too ill to wait until the following morning were treated after an MSU had been collected.

Specimens were received at the surgery each morning and the ' Uriglox ' test performed while the patient waited. According to the severity of the patients' symptoms a decision was made whether to initiate treatment immediately or to await bacteriological confirmation from the hospital laboratory on this specimen and on a second confirmatory specimen. Since the surgery had a small incubator and a fresh stock of cystine lactose electrolyte deficient medium, (CLED) the Leigh and Williams (1964) paper strip screening test for bacteriuria was undertaken by a trained nurse at the end of the morning surgery. The specimen was tested for gross glycosuria with ' Clinistix '.

When the tests were completed, the CLED plates were incubated at 37° and the urine refrigerated at 4°C. The hospital laboratory, which was ten miles away, was telephoned and the staff told of the number of specimens which were ready for collection.

At the end of the routine day, the technician on duty travelled to the practice and collected the refrigerated urine specimens and replenished the stocks of CLED media, ' Clinistix ' strips and plastic containers.

Specimens were cultured the same evening at the laboratory. All urines were cultured by a surface viable counting technique on CLED medium and the filter paper technique was repeated on the same medium. White cells were counted on the uncentrifuged urine in a Burker counting chamber and a Gram-stain of the centrifuged deposit was made. Paper strip tests were performed to detect proteinuria ' Albustix ' and pH was measured. The ' Clinistix ' and ' Uriglox ' tests were repeated.

After overnight incubation the cultures were examined and a preliminary report was telephoned each morning to the surgery. Contact was made with the patient if an earlier appointment or further specimens were required. The preliminary report included sensitivity results of infecting organisms from the routine direct sensitivity tests made. This early information helped the management of infected symptomatic patients. The results of the ' Uriglox ', ' Clinistix ' and Leigh and Williams tests undertaken at the surgery were not known to the hospital laboratory staff until treatment had been started.

When possible, a second confirmatory urine specimen was obtained, but, on occasions, appropriate treatment was started after a single specimen containing more than 10^5ml of a single type of organism. The patients were given one week's course of sulphadimidine, ampicillin or co-trimoxazole as appropriate. They were asked to bring a specimen of early morning urine to the surgery one week after completion of the treatment as part of their follow-up.

All urinary bacterial isolates were identified by standard bacteriological methods. The ' Uriglox ' test was performed according to the manufacturer's instructions supplied with the test.

Results

The results of screening for symptomatic bacteriuria in 55 patients in general practice are shown in table 1. This shows that 11 patients had confirmed bacteriuria, one being a diabetic. This patient was the only one in whom a false negative ' Uriglox ' test was confirmed. Nine patients with significant bacteriuria on first testing were treated before a second confirmatory specimen became available.

TABLE 1

THE RESULTS OF SCREENING FOR BACTERIURIA IN 55 SYMPTOMATIC PATIENTS IN GENERAL PRACTICE

Cultures	*Number of patients*	
	First attendance	*Second attendance*
More than 10^5 organisms/ml	25*	11* (9 not retested)
Less than 10^5 organisms/ml	30	35
Total	55*	46*

*Includes one patient with diabetes.

TABLE 2

THE RESULTS OF URIGLOX TESTS ON 43 URINE CULTURES CONTAINING MORE THAN 10^5 ORGANISMS/ML AND 58 URINE CULTURES CONTAINING LESS THAN 10^5 ORGANISMS/ML

Bacterial count	*Number of specimens*	*' Uriglox '*	
		Positive	*Negative*
More than 10^5 organisms/ml in pure culture	32	26	6*
More than 10^5 organisms/ml in mixed culture	11	2	9
10^4–10^5 organisms/ml	4	1	3
Less than 10^4 organisms/ml	54	0	54
Total	101		

*3 urines from diabetic patients

The results of ' Uriglox ' tests on 101 urines received from 55 patients are shown in table 2. This table shows that six negative ' Uriglox ' tests occurred in 32 urine specimens containing more than 100,000 organisms/ml of a single species. Three of these specimens were received from patients with diabetes. One positive ' Uriglox ' is recorded out of 58 urines which contained less than 100,000 organisms/ml. This table also shows, that of 11 urine samples which contained mixed cultures of more than 100,000 organisms/ml, the ' Uriglox ' test was positive on only two occasions.

Of the 11 patients with confirmed bacteriuria, eight were infected with *Escherichia coli* which was fully sensitive to nitrofurantoin, sulphonamide, ampicillin and trimethoprim, the remaining three patients were infected with *Proteus mirabilis*.

Discussion

Encouraged by the advent of group practices and the reorganisation of primary care services, general practitioners are making more use of laboratory services, and are well aware of the emphasis laid on preventive medicine. Kuenssberg *et al.* (1970) drew attention to their experience in general practice of the Leigh and Williams paper-strip technique using group practice incubators. We have had similar experience. (Mond, Gruneberg and Smellie, 1970). Nevertheless, this reliable screening method requires an 18–24 hours incubation (or delay) period.

The ' Uriglox ' test gives a reliable answer in six to eight minutes and, if positive, indicates the need for bacteriological confirmation.

One of the main problems in evaluating any screening test in general practice is that a second confirmatory specimen is often not available since a severe symptomatic infection requires immediate treatment. Table 1 shows that 11 patients had confirmed bacteriuria and a further nine patients were treated before a second confirmatory specimen became available. With the notable exception of one diabetic, none of the patients with confirmed bacteriuria had a confirmed false negative ' Uriglox ' test. The sensitivity of the test is therefore 100 per cent in this series.

Table 2, however, shows that ' Uriglox ' was negative on three occasions when the urine samples contained an excess of 10^5 organisms/ml. None of the three false negatives was confirmed when subsequent early morning fasting urines were tested.

Table 2 highlights an important advantage of ' Uriglox ' as a screening test, namely that it can distinguish between contamination and infection. Mixed cultures usually signify contamination rather than true infection. Of the 101 specimens received, 11 specimens contained mixed cultures with more than 100,000 organisms/ml although ' Uriglox ' was positive on only two occasions. Of these two patients, one was treated before a second specimen was obtained and the other patient subsequently produced two specimens containing more than 10^5 organisms/ml with positive ' Uriglox ' tests. The remaining nine patients with mixed cultures containing

more than 10^5 organisms/ml and negative ' Uriglox ' tests, provided second specimens with less than 10^3 organisms/ml and negative tests.

' Uriglox ' should not be used to screen patients with diabetes for bacteriuria, bacteriological cultures being essential.

Escherichia coli remains the most frequently isolated causative organism of urinary tract infection and in this general practice remains sensitive to sulphonamides and ampicillin.

Of the 11 patients with confirmed bacteriuria only two patients presented with more than a trace of protein as indicated by ' Albustix ' strips. This test had no use as an index of the presence of infection.

The results of the ' Uriglox ' test, ' Clinistix ' tests and Leigh and Williams strip tests which were undertaken at the surgery correlated exactly with the results obtained by the laboratory, and illustrates the comparative ease with which these tests can be carried out in general practice.

While ' Uriglox ' is a simple and rapid screening test for significant bacteriuria in general practice, the main disadvantage is that it has to be used on an early morning or fasting urine (i.e. urine that has been in the bladder more than four hours). The nature of the test, however, does not provide a means for bacteriological confirmation and sensitivity tests so that either the specimen must be transported to the laboratory or a dip slide is used on the ' Uriglox ' positive specimens.

The terminology of the positive ' Uriglox ' test was the only disadvantage in surgery use. Confusion occurred when the absence of a blue colour on the strip was termed positive and was synonymous with an infected, abnormal and hypoglucosuric urine.

' Uriglox ' is recommended as a useful adjunct to the general practitioners' armamentarium in the detection of significant bacteriuria and in particular is of value in the management of patients with recurrent and chronic urinary infection.

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