

INDIVIDUAL STUDY

Dip-slide urine cultures in general practice

D. W. MACLEAN, M.B., CH.B., F.R.C.G.P.

FIONA M. MCCALLUM, R.G.N., S.C.M.

Department of General Practice, University of Edinburgh
and

B. I. DAVIES, M.B., B.S., M.R.C.PATH.

Department of Bacteriology, University of Edinburgh

SYMPTOMS which are commonly considered to be associated with urinary tract infection are frequently reported by patients in general practice but, in many instances, bacteriological examination of the urine reveals no evidence of infection (Gallagher, Montgomerie and North 1965, Mestitz, McIntosh and Sleigh 1965). The bacteriological diagnosis of urinary infection depends not only on obtaining a pure growth on culture but also on demonstrating the presence of significant numbers of bacteria in the urine. A figure of more than 100,000 organisms per ml of urine, as estimated by viable bacterial counts, has been widely accepted as denoting "significant bacteriuria" (Kass 1955, Brumfitt and Reeves 1968).

Various methods have been described for simplifying this procedure, for example, semiquantitative laboratory cultures (Leigh and Williams 1964, Gould 1965) and nitrate reduction tests (Sleigh 1965). Some of these can be carried out by the practitioner in his own surgery premises but require the provision of incubators or waterbaths. Specimens yielding 'positive' results still have to be sent to the laboratory for confirmation and identification of the organisms present and for antimicrobial sensitivity tests to be carried out. Any delay in transmission to the laboratory may lead to deterioration of the specimen and overgrowth of any contaminating bacteria present.

In describing a new and simple dip-slide method for estimating viable bacteria in urine specimens Naylor and Guttman (1967) claimed that it overcame the difficulties "caused by the proliferation of contaminating bacteria in urine after collection" and would be of value in the diagnosis of urinary tract infections in general practice.

The present investigation has been designed to test the reliability of dip-slide cultures set up in a general practice and read either by the general practitioner himself or by an ancillary without microbiological training.

Methods and materials

Mid-stream urine specimens were collected by the practice nurse from 100 consecutive female patients, aged 15 to 44, attending with one or more of the following acute urinary symptoms—frequency of micturition, dysuria, nocturia, haematuria or loin pain. Only one specimen from each patient was included in the study and it was obtained at the practice premises at her first attendance for the complaint.

Each patient was instructed how to collect the mid-portion of the urine stream in a clean waxed paper container (Thomas and Clark 1962), after cleansing the vulva with a 1 per cent aqueous solution of chlorhexidine. A 'Uricult' dip-slide was removed from its container, dipped into the urine and then removed. The excess liquid was allowed to drain off on to absorbent paper and the slide was then returned to its labelled container which was sealed and left in a warm room (temperature range 20 to 24 deg C) in the

surgery premises for 18 to 24 hours. The results were read independently by the practice nurse (F.M.M.) and the general practitioner (D.W.M.) under identical conditions. After the 'Uricult' results were recorded by the two practice observers, the dip-slides were taken to the laboratory where they were incubated for a further 18 hours at 37 deg C before assessment by the bacteriologist (B.I.D.). Three sets of 'Uricult' readings were thus obtained.

The specimen of urine itself was sent within two hours to the laboratory by the routine collecting service van or, if a delay was inevitable (*eg* overnight) it was stored in a refrigerator at 4 deg C until it could be taken to the laboratory. Viable bacterial counts were carried out on the urine sample using a simple modification of the method described by Miles and Misra (1938) in which hundred-fold urine dilutions were spot-inoculated on to well-dried blood agar plates. The counts were read after overnight incubation in the laboratory at 37 deg C and were used as reference standards.

TABLE I
CATEGORIES USED FOR THE VIABLE BACTERIAL COUNTS IN THE COMPARISON OF RESULTS

<i>Category</i>	<i>Result of culture</i>	<i>Viable count/ml.</i>	<i>Cultural findings</i>
A	Significant bacteriuria	$>10^5$	Pure growth
B	Doubtful bacteriuria	10^4-10^5	Pure growth
C	Insignificant bacteriuria	$<10^4$	Pure growth
		<i>or</i> $<10^5$	Mixed growth
D	Contaminated specimens	$\geq 10^5$	Mixed growth

The viable bacterial count results allowed each urine specimen to be allotted to one of four categories as set out in table I. On the basis of the chart supplied by the manufacturers, which gives a pictorial representation of the dip-slide appearance with five bacterial densities (10^3 , 10^4 , 10^5 , 10^6 , 10^7), each 'Uricult' specimen was allocated to one of four categories as listed in table II.

TABLE II
CATEGORIES USED FOR THE 'URICULT' RESULTS IN THE COMPARISON OF RESULTS

<i>Category</i>	<i>Manufacturer's chart</i>	<i>Cultural findings</i>
a	$>10^5$	Pure growth
b	10^4-10^5	Pure growth
c	$>10^4$	Pure growth
	<i>or</i> $<10^5$	Mixed growth
d	$\geq 10^5$	Mixed growth

Results

The results are set out in table III which shows a comparison of the 'Uricult' findings with the viable bacterial counts. Of the 19 specimens which were shown by the viable counts to contain significant numbers of bacteria the nurse's findings coincided in 16 (84 per cent) and the doctor's in 15 (79 per cent). Of the 75 specimens showing insignificant bacteriuria by the reference test, the nurse identified all and the doctor 73, a specificity of 100 per cent and 97 per cent respectively.

The bacteriologist's findings in the dip-slide test, read after a further incubation period at 37 deg C in the laboratory, are also shown in table III. The sensitivity was increased in that he identified 18 of the 19 bacteriuric specimens (95 per cent) but the

specificity of the test was reduced to 95 per cent in that he recorded as negative only 71 out of the 75 specimens which showed insignificant bacteriuria by the viable count.

TABLE III
COMPARISON OF THE 'URICULT' RESULTS WITH THE VIABLE BACTERIAL COUNTS

Observer	'Uricult' result	Viable bacterial count category				Total
		A	B	C	D	
Nurse	a	16	2	—	—	18
	b	—	1	—	1	2
	c	3	2	75	—	80
	d	—	—	—	—	0
General practitioner ..	a	15	1	—	—	16
	b	1	2	2	—	5
	c	2	2	73	1	78
	d	1	—	—	—	1
Bacteriologist	a	18	1	1	—	20
	b	—	3	1	—	4
	c	—	1	71	—	72
	d	1	—	2	1	4
TOTALS		19	5	75	1	100

In the 19 positive specimens identified by viable bacterial count the organisms found were *Escherichia coli* 15 times, *Staphylococcus albus*, twice, *Proteus mirabilis* once, and *Klebsiella* species once. Four of the 'doubtful' specimens contained *Escherichia coli* and the other *Staphylococcus albus*.

Discussion

Some workers have found difficulty with the media supplied on the slides. Maskell and Polak (1970) discovered that many specimens containing Gram-positive bacteria yielded no growth at either room temperature or in an incubator, and Hughes (1970) only obtained reliable results when the MacConkey medium on the slides was improved and standardized to facilitate the growth of enterococci. These latter organisms were not isolated from any of the patients in the present survey even by the use of blood agar plates in the laboratory with incubation at 37 deg C.

Arneil, McAllister and Kay (1970) showed that the incubation of the dip-slides at room temperature did not produce false negative results compared with the test cultures at 37 deg C for the same period of 18 hours. They also suggested that an important advantage was the ease by which dip-slide cultures may be inoculated in general practice and despatched to the laboratory, without delay in transmission causing false positive results.

Wille, Schärer and Bickel (1970) claimed that the incubation of dip-inoculum cultures in a warm room was unsatisfactory, particularly where there were borderline or doubtfully significant bacterial counts, and recommended a controlled incubation temperature of 37 deg C. This finding has not been widely confirmed and accurate dip-slide results have also been reported by Mabeck and Mabeck (1970) following incubation at room temperature.

In the present study, as few as 19 of the 100 women with acute urinary symptoms did show significant bacteriuria: in the same practice Mestitz, McIntosh and Sleigh (1965) found that only 24 per cent of the patients with urinary symptoms actually had significant bacteriuria. These results suggest that a large proportion of general-practice urine specimens sent to a laboratory are likely to prove negative. The use of the dip-slide

technique as a screening procedure to be carried out by the general practitioner or his nurse could therefore reduce the laboratory work-load in the diagnosis of urinary infection. From the general practitioner's point of view, the time to obtain a negative result is greatly reduced in that the test remains in his consulting premises and is read after 18 hours.

The 'Uricult' results of specimens which showed insignificant bacteriuria by the reference test were remarkably accurate, since the nurse identified all of them and the practice doctor 97 per cent. If one assumes that doubtful or contaminated dip-slides (categories 'b' and 'd', table III) would require to be repeated and that positive dip-slides (category 'a') would be sent to the laboratory for confirmation of the organisms present and their sensitivity to antimicrobial drugs, there remain those specimens which would have been falsely discarded as negative. Such specimens numbered five among those recorded by the nurse, namely, three containing significant numbers of organisms and two showing bacteriuria of doubtful significance. The general practitioner's results included five which were regarded by him as negative whereas the viable counts demonstrated the presence of significant bacteriuria in two, doubtful bacteriuria in two and one contaminated specimen. Even so, these false negatives were few in comparison with the number correctly identified.

This survey provides an example of the value of the practice nurse to the general practitioner. Her rôle in supervising the collection of mid-stream specimens of urine is obvious but this survey has shown that by using the 'Uricult' dip-slide technique, the nurse can go further and produce results which compare favourably with those obtained in the laboratory.

Summary

Urine specimens were obtained from 100 consecutive female patients aged 15 to 44 years who consulted at a general practitioner's surgery because of acute symptoms. These specimens were assessed at the laboratory by viable bacterial counts and also by the 'Uricult' dip-slide system of bacterial culture both in the practice and in the laboratory. The results in the practice show that the two observers obtained 'Uricult' results coinciding with the viable bacterial counts in 79 and 84 per cent of the bacteriuric specimens and in 97 and 100 per cent of those containing an insignificant number of bacteria. After further incubation in the laboratory, the 'Uricult' dip-slides identified 95 per cent of the positive specimens and 95 per cent of those shown by the reference test to be negative.

Acknowledgements

The authors wish to thank Bristol Laboratories for supplying the 'Uricult' kits also their colleagues in the departments of bacteriology and general practice, University of Edinburgh, for their interest and help.

REFERENCES

- Arneil, G. C., McAllister, T. A., and Kay, P. (1970). *Lancet*, **1**, 119.
Brumfitt, W., and Reeves, D. S. (1968). *Presymptomatic Detection and Early Diagnosis*, p. 179. Eds. the late C. L. E. H. Sharp and H. Keen. Pitman Medical Publishing Company, London.
Gallagher, D. J. A., Montgomerie, J. Z., and North, J. D. K. (1965). *British Medical Journal*, **1**, 622.
Gould, J. C. (1965). *British Journal of Urology*, **37**, 7.
Hughes, M. H. (1970). *Lancet*, **2**, 420.
Kass, E. H. (1955). *American Journal of Medicine*, **18**, 764.
Leigh, D. A., and Williams, J. D. (1964). *Journal of Clinical Pathology*, **17**, 498.
Mabeck, K., and Mabeck, C. E. (1970). *Lancet*, **1**, 465.
Maskell, R., and Polak, K. (1970). *Lancet*, **2**, 309.
Mestitz, P., McIntosh, W. G., and Sleigh, J. D. (1965). *Practitioner*, **195**, 328.
Miles, A. A., and Misra, S. S. (1938). *Journal of Hygiene (Cambridge)*, **38**, 732.
Naylor, G. R. E., and Guttman, D. (1967). *Journal of Hygiene (Cambridge)*, **65**, 367.
Sleigh, J. D. (1965). *British Medical Journal*, **1**, 765.
Thomas, C. G. A., and Clark, D. H. (1962). *Lancet*, **2**, 407.
Wille, L., Schärer, K., and Bickel, H. (1970). *Lancet*, **2**, 105.