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A study of some of the methods of urinary collection in children

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SYNOPSIS Three methods of urine collection used currently in the diagnosis of urinary tract infection in children were studied. One hundred and fifty-two hospital patients were investigated: 92 by clean-catch method, 32 by the adhesive plastic bag technique, and 28 by suprapubic bladder aspiration. Results indicate that in the great majority of children a satisfactory diagnosis can be made on bacteriological grounds by the examination of specimens passed naturally and collected with care. In a minority of cases further investigation by such means as bladder aspiration may be indicated and this gives conclusive results.

To establish with certainty the presence of a bacteriuria significant of infection in children is both a difficult and important task. Care in urine collection is accepted as of crucial importance but doubt still remains as to the most reliable method applicable to children. The two main alternatives are collection by natural means and instrumentation. It is anticipated, however, that the latter method may be adopted only in a minority of cases. Certain aspects of the clean-catch and adhesive bag methods were studied in two wards of a children's hospital, and from the results of these, suprapubic bladder aspiration was carried out in a third ward on a selected group of cases.

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Materials and Methods

In ward A clean-catch specimens with and without preliminary toilet were compared. Children of both sexes and all ages with symptoms in any way referable to urinary tract infection were examined before treatment. Two specimens were collected from each patient by a nurse. The urine was passed directly into a sterile kidney dish and transferred to a universal container. This was placed in a thermos cooling flask for transport to the laboratory where culture as described by Urquhart and Gould (1965) was carried out. The first specimen had no preliminary preparation (clean-catch urine). The second was preceded by swabbing of the genitalia and perineum with sterile wool soaked in 1 : 800 hypochlorite solution, cleansing with sterile saline, and drying with sterile wool. One hundred and five paired speci-

Group	Urine	Males Total	Males Age Group (yr) 0-1	1-3	3-6	6-14	Females Total	Females Age Group (yr) 0-1	1-3	3-6	6-14	Total
	Number of paired urines examined	53	23	3	9	18	52	11	11	16	14	105
I	Number showing no growth (both methods)	29	5	3	8	13	25	1	6	9	9	54 (52%)
II	Number showing identical bacterial counts (clean-catch and treated)	16	12	0	1	3	18	4	4	5	5	34 (32%)
III	Number showing lack of correspondence between treated and clean-catch	8	6	0	0	2	9	6	1	2	0	17 (16%)

Table I *Bacteriological results of untreated and treated specimens in relation to age and sex*

mens from 92 children were examined in this way.

In ward B the adhesive plastic bag technique was studied with particular reference to the problem of contamination. Fifty-six observations were made on 32 children (10 male and 22 female of whom 16 were under 1 year, 13 aged 1-2 years, and three aged 2-3 years). Three specimens were examined bacteriologically from each patient: (1) a dry swab of the interior of the bag before application; (2) a dry swab of the perineum of females and the prepuce of males to provide evidence of the commensal bacteria; (3) urine from the bag transferred to a universal container as soon as possible after voiding.

Urine was examined as in experiment A, while material from swabs 1 and 2 was plated on to blood agar and MacConkey media and incubated for 48 hours at 37°C.

Where possible, it is wise practice to examine a series of specimens by either of these methods to increase the accuracy of diagnosis. But in some cases, equivocal or contradictory results make a conclusion impossible and further repetition may only exaggerate this doubt. It seems reasonable then to proceed to some form of instrumentation. In ward C, 28 such untreated children (19 females and nine males) were investigated by suprapubic bladder aspiration as described by Pryles, Atkin, Morse, and Welch (1959). Of these patients, 14 females and eight males were under 2 years of age. The result of the most recent clean-catch or bag specimen of each was used as a control.

Culture		Male	Female	Total	
Bag	Number from which no organisms isolated	14	42	56	(100%)
Perineal	Number with no organisms isolated from prepuce or perineum	5	16	21	(37%)
	Number with mixed surface organisms	9	26	35	(63%)
Urine	Number with no growth	4	7	11	(20%)
	Number with bacterial counts $<10^5$ organisms/ml	9	29	38	(68%)
	Number with counts of 10^5 organisms/ml	1	3	4	(7%)
	Number with counts of $>10^5$ organisms/ml	nil	3	3	(5%)

Table II *Comparative results of bacteriological examination of 56 bags, perinea, and urines*

Results and Comment

The purpose of experiment A was to show if the results of untreated and treated specimens coincided sufficiently to give an accurate bacteriological diagnosis, and, if not, to show if preliminary cleansing gave better results. A remarkable degree of consistency was in fact demonstrated (Table I). In 54 instances there was good evidence that infection was not present. A further 34 gave identical results (in regard to both species and count), of which 19 were 10^4 organisms/ml, and all but one mixed and was not therefore considered significant. Discrepancies between treated and untreated specimens existed in 17 cases. Twelve of these showed a tenfold difference in count (the minimum which could be reliably detected by the cultural method used), the species isolated being alike in all cases. The remaining five had no growth from one specimen and a mixed growth from the other. In interpreting the significance of these bacterial counts three points were considered simultaneously: the total count, the purity of the growth, and the identity of the isolate. On this basis a fairly reliable diagnosis was reached when the counts were related to white blood cell excretion and general clinical assessment. In all, 32 paired samples gave results suggestive of infection. Of these 13 (from 32 children, four in group II and nine in group III in Table I) had a count of 10^5 organisms/ml in one specimen—an equivocal result. Nineteen had a count of 10^6 organisms/ml or more (11 in group II and eight in group III) and were eventually accepted as cases of infection.

As regards the value of antiseptic toilet, 38 paired specimens gave identical results. Of the 17 showing some discrepancy, higher counts were obtained by the treated method in 11, nine of which showed multiple species, while a higher count was obtained by the clean-catch method in six, five of which consisted of a single species. It would appear that toilet made little difference to the result, any difference being in favour of the clean-catch method. This finding agrees with the view of Turner (1961) that in a series of antenatal patients preliminary cleansing gave no better results.

As was expected, less conclusive results were reached from experiment B (Table II), since it

applied to the age group most difficult to diagnose. Results showed that contamination could not be attributed to the bags themselves and that the perineal surfaces were not the consistent source of contamination. Of 21 patients whose perineal swabs yielded no growth, 16 had growths in the urine, and of 11 with no growth in the urine, six showed organisms present in the perineum: in a further six cases the species from the local sites were entirely different from those isolated in the urine. Thus in over 50% there was no demonstrable causal relationship between the two. Only seven results (from five patients) were suggestive of significant bacteriuria, ie, 10^5 organisms/ml or more. Of these, three (from two patients) gave counts of 10^6, 10^6, and 10^7 organisms/ml in a single species and were associated with no growth from the perineal swabs and were regarded as significant of infection. The remaining four (from three infants under 1 year of age) had counts of 10^5 organisms/ml and were considered of doubtful significance. Thirty-eight with counts of $<10^5$ organisms/ml were bacteriologically not considered significant since 20 consisted of multiple species and 18 a single species at 10^4 organisms/ml or less. Overall, the small number of high bacterial counts is worthy of emphasis as it suggests that even if some delay occurs in the removal of the bag after the passing of the specimen the proliferation of organisms is not of great account when the specimen is maintained at a low temperature. These results contrast markedly with those of Braude, Forfar, Gould, and McLeod (1967) who reported counts of 10^5 organisms/ml in 50% and 10^6 organisms/ml in 15% of normal children under 2 years of age.

The results of bladder aspiration in all examined cases were clear-cut (Table III). In the five positive

Sex	*Age*	*Bag or Clean-catch Urine Count (organisms/ml)*	*Source of Specimen*	*Aspirate Count (organisms/ml)*	*Time between Specimens (days)*
F	2 mth	Proteus *Esch. coli* (2 strains) 10^6	Bag	*Esch. coli* 10^5	Same day
M	3 mth	*Esch. coli* 10^7	Bag	*Esch. coli* 10^5	Same day
F	8 yr	*Esch. coli* 10^6	Clean catch	*Esch. coli* 10^6	Same day
F	8 yr	Coliform bacilli 10^7	Clean catch	Coliform bacilli 10^6	Same day
F	10 yr	Proteus 10^8	Clean catch	Proteus 10^7	Same day
F	1 mth	*Esch. coli* 10^6	Bag	No growth	2
M	2 wk	*Esch. coli* 10^4 *Staph. pyogenes* 10^6	Bag	No growth	4
F	7 mth	Proteus 10^5	Bag	No growth	Same day
F	11 yr	*Esch. coli* Enterococcus } 10^4	Clean catch	No growth	Same day
M	3 wk	*Esch. coli* 10^7	Bag	No growth	1
M	3 yr	*Esch. coli* 8000	Clean catch	No growth	Same day
F	2 wk	*Esch. coli* Proteus Enterococcus } 10^6	Bag	No growth	5
M	2 mth	*Ps. pyocyanea* Proteus *Esch. coli* } 10^5	Bag	No growth	4
F	5 days	Enterococcus 10^5	Bag	No growth	3
F	16 mth	Mixed coliform bacilli	Bag	No growth	2
F	9 mth	Proteus 10^7	Bag	No growth	2
M	2 wk	*Esch. coli* 10^5	Bag	No growth	Same day
M	2 mth	Proteus (small nos.)	Clean catch	No growth	2
F	9 mth	*Esch. coli* Proteus Enterococcus } 10^5	Bag	No growth	2
M	2 wk	*Esch. coli* 10^5	Clean catch	No growth	Same day
F	3 wk	*Esch. coli* Enterococcus } 10^4	Bag	No growth	Same day
F	3 mth	*Esch. coli* Proteus } 10^6	Bag	No growth	3
F	3 mth	*Esch. coli* 10^5	Bag	No growth	4
F	2 wk	*Esch. coli* Proteus Enterococcus } 10^5	Bag	No growth	Same day
F	1 mth	Coliform bacilli 10^7	Bag	No growth	Same day
M	1 mth	*Esch. coli* 10^6	Bag	No growth	3
F	3 mth	Proteus *Esch. coli* } 10^5	Bag	No growth	1
F	2 yr	Coliform bacilli 10^5	Bag	No growth	4

Table III *Bacteriological results of 28 bladder aspirated urines compared with clean-catch or bag urines*

cases, the species isolated from both the clean-catch and aspirate specimens were alike although the count in the latter was slightly lower (approximately 10^1). The remaining 23 proved to be negative. This finding supports the belief that in young children growths of mixed organisms in varying numbers are mainly due to contamination and that in general there is a tendency to false positives from urine specimens collected by standard methods.

Conclusion

From the studies A and B it is clear that a considerable proportion of children can be confidently diagnosed by the methods at present practised. There will inevitably be some children, particularly those under 2 years of age, who give puzzling results, on whom it seems justifiable to carry out a further diagnostic procedure. Suprapubic aspiration has proved valuable in these doubtful cases, as shown in study C.

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