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Correlation of bacteriological flora of the urethra, glans and perineum with organisms causing urinary tract infection in the spinal injured male patient

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Positive urine cultures are common and often asymptomatic in the male spinal injured patient performing self clean intermittent catheterisation. It is possible that the positive urine cultures result from contamination from the colonised urethra at the time of catheterisation. This contamination could result in true infection of the bladder urine or yield false positive results, explaining the frequently seen asymptomatic cases.

In a prospective study positive urine cultures were found on 58 occasions (74%) in 10 asymptomatic patients studied. In 19% of screenings, with positive urine cultures, an identical organism was cultured from the catheter specimen of urine, the perineum and the urethra. The flora of the anterior urethra is strongly correlated to that of the perineum (37.1%), as well as that of the bladder (52.6%). In 4 patients a correlation also existed between the urethra and fingers, and the perineum and fingers. This was associated with an increased incidence of positive urine culture in these patients. Suprapubic aspirates of urine before and after catheterisation cultured the same organisms. However, quantitative culture revealed colony counts that approached a 10-fold increase following catheterisation in one patient. This suggests that catheterisation is at least partially responsible for ascending infection in this group of patients. Catheter specimens were found to be a good representation of the bladder urine, with an 87.5% correlation.

Keywords: urinary tract infection; self catheterisation; bacterial flora; paraplegia.

Introduction

Positive urinary cultures are common in the male spinal injured patient performing self clean intermittent catheterisation. In the paraplegic the skin of the perineum and groin has been shown to be stably colonised with organisms associated with urinary tract infection.[1,2] Fawcett *et al* in 3 patients identified organisms on the perineum that were subsequently the cause of urinary tract infections.[3] A previous study from this unit revealed that, in 20 of the 30 episodes of urinary tract infection investigated, an organism identical to that causing the infection was recovered from the patients' bedding.[4] This was assumed to be due to contamination from the perineum, the urethra or urine, but these sources were not studied as part of the original investigation.

However, these infections are often asymptomatic, with no malaise, no fever and no increased dysreflexia or reflex incontinence, and it is no longer our policy to treat asymptomatic urinary infections in this group of patients. It is possible that the positive urine cultures result from contamination of the catheter by the stably colonised urethra, at the time of catheterisation. Catheter contamination could result in infection of the bladder urine or yield false positive results, explaining the frequently seen asymptomatic cases.

We therefore undertook a two-part prospective investigation. Firstly, we studied the

correlation of the bacteriological flora of the uretha, glans, perineum and other sites with the organisms causing urinary tract infection in male patients performing self clean intermittent catheterisation. Secondly, we looked at the bacterial flora of the bladder at the time of catheterisation.

Patients, materials and methods

Ten male inpatients, on the Spinal Injuries Unit, Royal National Orthopaedic Hospital, Stanmore, undergoing clean intermittent self catheterisation were enrolled and studied twice weekly. All were asymptomatic at the time of enrolment, and symptomatic infection requiring antibiotic therapy excluded them from further study. Catheterisation was performed 4–5 times daily by the patient using a 'clean' technique and disposable Nelaton catheters. The specimens taken included fingerprints taken directly onto Petri dishes containing MacConkey agar, and nasal, perineal and urethral swabs, which were plated immediately on the same medium. These were taken immediately prior to self catheterisation, which was carried out with a sterile disposable Nelaton catheter. A catheter specimen of urine was collected into a sterile universal container. Specimens were cultured at 37 °C and identified by standard methods. Strains with common sensitivities to antibiotics were further tested in the API 20E system, and regarded as identical if the antibiograms and API formula were the same.

A further 8 asymptomatic male patients underwent suprapubic collection of urine before and after catheterisation. Swabs from the glans penis and anterior urethra were taken and plated immediately on CLED and blood agar. Suprapubic puncture was performed with a fine-bore needle, after initial skin preparation with aqueous chlorhexidine solution and local anaesthetic, if necessary. An aliquot of urine was withdrawn into a sterile syringe and transferred to a sterile universal container. A spigoted sterile disposable catheter was then passed using sterile lubricant and a second suprapubic specimen obtained from the indwelling fine-bore needle. A catheter specimen of urine was then obtained. Urine specimens were cultured on blood agar and by serial dilution on CLED agar to enable a quantitative analysis. The method used would not distinguish less than a 10-fold difference in bacterial count with confidence.

Symptomatic patients taking antibiotics were excluded during treatment.

Results

In the first group 78 complete sets of results were available. Of these 58 (74%) had positive urine cultures. On 11 occasions (19% of those with positive urine cultures) an identical organism was cultured from the catheter specimen of urine (CSU), the perineum and the urethra (Table I). The closest correlation, as expected, existed between the urethral swabs and the CSU and 41 (70.7% of those with positive urine cultures and 52.6% overall) had identical organisms.

In a number of patients these organisms were also recovered from the nose and finger tips. An identical organism was recovered from the fingers and the urethra in 4 of the 10 patients on 14 screenings (17.9%). The positive nasal correlation was

Table I Correlation of positive cultures from 78 screenings of 10 male patients performing clean intermittent self catheterisation (58 positive urine cultures—74%)

Positive correlation		
UPC	Number	11
	% of +ve urines	19%
	% of total	14.1%
UP	Number	29
	% of total	37.1%
UC	Number	41
	% of +ve urines	70.7%
	% of total	52.6%
PC	Number	11
	% of +ve urines	19%
	% of total	14.1%

U = urethra
P = perineum
C = urine

less evident. Again, the strongest relationship existed between the nose and the urethra (5 occasions or 6.4% of screenings). The incidence of identical finger or nasal colonisation increased in the presence of a positive correlation between the other sites studied. In the 4 patients who had a positive correlation between finger and urethral cultures the incidence of positive urine culture was greater than in the other 6 patients (85% vs 66%). This difference was not statistically significant, however. The same 4 patients exhibited a positive correlation between the organisms cultured from the fingers and the perineum, and in 2 of the 4 identical organisms were also recovered from the finger and urine cultures.

Escherichia coli accounted for 37.9% of positive urine cultures (6 strains) with 20.7% culturing *Klebsiella pneumoniae* (Table II). During this study no 2 patients were found to have the same organism in the urine at the same time, although similar strains were identified at different times. The progression of organisms from the perineum to the urethra or from the urethra into the bladder was identified on 4 occasions in 3 patients. The organisms concerned, however, were not fully identified by the API 20E system. Bacteria recovered from the anterior urethra were found to change frequently: in one patient there were 14 changes in consecutive culture in an 82-day period.

Table II Organisms in catheter specimens of urine (58 positive cultures—74%)

Organism	No of episodes	Incidence (%)
E. coli (6 strains)	22	37.9
Klebsiella pneumoniae (2 strains)	12	20.7
Enterococci	7	12.1
Proteus mirabilis (5 strains)	6	10.3
Klebsiella oxytoca (2 strains)	2	3.4
Pseudomonas	2	3.4
Ent. aerogenes	2	3.4
Serratia marcescens	1	1.7
Mixed cultures	5	8.6

In the group undergoing suprapubic aspiration of urine, all pre and post catheterisation specimens cultured the same organisms, ie there was no evidence of new vesical contamination at the time of catheterisation. Quantitative culture revealed different colony counts, but approaching a 10-fold magnitude on only one occasion. Six of 8 (75%) had identical organisms in their suprapubic urine and the catheter specimens. One patient cultured *Staphylococcus epidermidis* from the CSU but not the suprapubic urine; the organism was also present on the glans and in the urethra. This represents a false positive result presumably from contamination of the catheter at the time of insertion. One subject cultured staphylococci from both suprapubic aspirations but not from the CSU, probably skin contamination at the time of puncture. Organisms identical to those found in the bladder were recovered from the glans penis and urethra in all cases.

Discussion

This prospective study confirms that, in this group of asymptomatic patients performing clean intermittent self catheterisation, positive urine cultures are common (75.6% overall). As expected, the organisms recovered were those associated with urinary tract infections. *Escherichia coli* accounted for 37.9% of positive urine cultures (6 strains) with 20.7% culturing *Klebsiella pneumoniae* (Table II). Suprapubic aspiration of urine before and after catheterisation showed that in only a minority are the positive urine cultures the result of contamination of the catheter at the time of insertion (12.5%) and therefore catheter specimens are a good representation of the bladder urine.

The closest correlation, as expected, existed between the urethral swabs and the catheter specimen of urine: 41 (70.7% of those with positive urine cultures and 52.6% overall) had identical organisms. This could be explained by urethral contamination by the leakage of infected urine from the bladder between catheterisations. But in 48.4% of screenings different organisms were recovered from the anterior urethra

and the bladder, and in the second study group identical organisms were recoverable from the glans penis and urethra. These findings both suggest true colonisation of the anterior urethra, not merely contamination by infected urine.

There was also a strong relationship between the flora of the urethra and the perineum (37.1% of screenings) and a less strong correlation between perineum and urine (19% of positive urine cultures and 14.1% overall). That positive urine culture in this group is associated with the perineal flora as well as that of the urethra suggests an ascending route of infection, and on 4 occasions progression from the perineum to the urethra or from the urethra to the bladder was identified. No evidence could be found to support the introduction of a new bacteria into the bladder at the time of catheterisation, but on one occasion the quantitative culture of urine approached a 10-fold increase following catheterisation. This suggests that catheterisation is at least partially responsible for ascending infection in this group of patients.

In a number of patients these organisms were also recovered from the finger tips and nasal swabs. Four patients were found to have a positive correlation between the fingers and the urethra, and the fingers and perineum. This was associated with an increased incidence of positive urine culture, and the fingers must be regarded as a further source for cross-infection. Hand washing in this group must be encouraged to prevent contamination throughout their living area. Despite this, no 2 patients in the study group had identical urinary tract infections at the same time, although similar strains were identified on separate occasions.

Conclusions

In male spinal injured patients performing clean intermittent self catheterisation, positive urine cultures are common and often asymptomatic. The bacteria recovered are those associated with the urinary tract infection, and catheter specimens of urine were found to be a good representation of bladder urine, with an 87.5% correlation.

The flora of the anterior urethra is strongly correlated to the flora of the perineum (37.1%), as well as that of the bladder (52.6%). Catheterisation appears to aid the ascending progression of bacteria, which was identified in 3 patients.

A positive correlation between the flora of the fingers and urethra, and the fingers and perineum was found in 4 patients. This was associated with an increased incidence of positive urine culture. The fingers must also be regarded as a source of cross-infection, and hand washing must be encouraged in this group of patients.

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