

Bacterial Culture of the Anterior Urethra and Its Relationship to Post-Operative Bacteriuria

L. Walker¹, I. King², B. J. Abel¹, A. G. Hutchison¹ and H. J. Lewi¹

Departments of Urology¹ and Bacteriology², Victoria Infirmary, Glasgow, UK

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Summary. The role of the anterior urethral culture and its relationship to post-operative urine infection in patients undergoing transurethral surgery was studied in 43 consecutive patients. A significant relationship between the anterior urethral culture and subsequent urine infection in patients with a sterile pre-operative urine was noted ($p < 0.01$).

Key words: Bacterial culture, Anterior urethral culture, Post-operative urinary tract infection, Transurethral surgery.

Post-operative urinary tract infection following transurethral surgery remains a significant complication. Antibiotic prophylaxis may in part play a role in reducing the incidence of the problem, though pre-operative therapy is of value only in those patients with a proven pre-operative urinary tract infection [3, 8]. The value of antibiotic prophylaxis in patients with sterile pre-operative urine remains controversial as a proportion of patients still develop post-operative bacteriuria despite the use of antibiotics [4, 8]. In this context, a method for identifying those patients with sterile pre-operative urine undergoing transurethral surgery who are most likely to develop post-operative bacteriuria would be of value, as appropriate steps may then be taken to provide antibiotic cover during the operative and post-operative period.

A prospective study is reported in which the bacteriological factors associated with an increased risk of post-operative bacteriuria were studied.

Patients and Methods

Forty-five consecutive patients undergoing transurethral resection (TUR) of bladder tumour (BT, $n = 10$), prostatic cancer (CaP, $n = 5$) or benign prostatic hypertrophy (BPH, $n = 30$), were studied.

In patients undergoing TUR for BPH, 15 presented with retention and were catheterised prior to theatre, the remaining 15 patients were admitted for elective transurethral resection. In addition 3 patients with bladder tumour and one patient with prostatic cancer were catheterised prior to theatre.

The age range of the patients was 37–87 years, with a mean of 68 years. In the 24 h prior to surgery, a midstream sample of urine (MSSU) was obtained in the routine manner and in those patients catheterised a standard catheter sample of urine was obtained (CSU). In addition a venous blood sample for culture was taken.

At operation an anterior urethral swab was taken prior to preparation of the patient. The swab was inserted into the anterior urethra and then placed in a standard Ames transport medium for aerobic and anaerobic culture. Following insertion of the cystoscope a sample of urine for culture was taken.

All cultures were assessed for aerobic and anaerobic organisms and a urine culture of $> 10^5$ organisms/ml was indicative of an established urinary tract infection.

A positive post-operative urine culture ($> 10^5$ organisms/ml) was considered significant if present following removal of the catheter, and was treated by appropriate antibiotic therapy.

Statistical Analysis

The significance of the relationship between a positive pre-operative bacteriological culture and subsequent urinary tract infection was assessed by the Chi square test with a Yates correction for small numbers, analysing the relationship between a positive pre-operative urine culture, positive urethral culture and the subsequent post-operative positive urine culture.

Results

Two patients were excluded from the study due to incomplete data, leaving 43 patients available for analysis.

Prior to operation seven patients (16%) had a positive urine culture from the urine, six (19%) had a positive culture from the urine sample obtained at cystoscopy, and in 17 patients (39%) a significant culture was obtained from the post-operative urine following removal of the catheter. In the 43 patients studied, 28 (65%) had a positive urethral swab culture (Table 1).

Table 1. Positive bacteriological findings in 43 patients

	Number	Pre-operative Catheter	Operative Bacteriology		Positive Post-operative Urine Culture
			Positive Urine Culture	Positive Urethral Swab	
Positive Pre-operative Urine Culture	7	4	6	7	6
Negative Pre-operative Urine Culture	36	15	4	21	11
Total	43	19	10	28	17

Table 2. Bacteriological findings in 7 patients with a positive pre-operative urine culture

No	Pathology	Pre-operative Catheter	Pre-operative Urine Culture	Urethral Swab Culture	Post-operative Urine Culture
1	B. T.	Yes	<i>E. coli</i>	<i>E. coli</i> <i>K. pneumoniae</i> <i>B. fragilis</i>	<i>K. pneumoniae</i>
2	B. P. H.	Yes	<i>E. coli</i>	<i>E. coli</i>	<i>E. coli</i>
3	B. P. H.	Yes	<i>P. mirabilis</i>	<i>P. mirabilis</i> <i>Strep. faecalis</i> <i>B. fragilis</i>	<i>P. mirabilis</i>
4	Ca. P.	Yes	<i>P. morgani</i> <i>Strep. faecalis</i>	<i>P. morgani</i> <i>Strep. faecalis</i>	<i>P. morgani</i>
5	B. T.	No	<i>K. pneumoniae</i>	<i>K. pneumoniae</i> <i>Strep. faecalis</i> <i>B. fragilis</i> <i>Anaer. strep</i>	<i>K. pneumoniae</i>
6	B. P. H.	No	<i>Strep. faecalis</i>	<i>E. coli</i>	<i>E. coli</i>
7	B. P. H.	Yes	<i>K. pneumoniae</i>	<i>K. pneumoniae</i>	---

a) Positive Pre-Operative Urine Culture (Table 2)

In the seven patients with a positive pre-operative urine culture all had a positive urethral culture and four had a significant culture from the urine specimen obtained at operation. Six patients developed a significant post-operation urine culture following removal of the catheter, and appropriate antibiotic therapy was instituted. In two of the six (Nos. 1 and 6) the post-operative urine culture was identical to the organisms isolated from the urethral swab, but differed from the pre-operative urine culture. In the remaining patient (No. 7), despite *K. pneumoniae* being isolated from the pre-operative urine and urethral swab, the post-operative urine culture remained sterile. The operative urine specimens obtained in four patients were identical to the organisms found in the urethral swabs and the pre-operative urine culture; in the remaining 3, operative urine specimens were negative.

From the results obtained, it appears that a significant relationship exists between a positive culture obtained in both the pre-operative urine and the urethral swab, and the

subsequent development of a post-operative urinary tract infection ($p < 0.01$).

b) Positive Urethral Swab Culture (Table 3)

In the 36 patients with a negative pre-operative urine culture, four were found to have a significant culture from the urine obtained at operation, and 21 (58%) had a positive urethral swab culture. Eleven of the 21 (52%) patients with a positive urethral swab and negative pre-operative urine culture developed a significant post-operative urinary tract infection (Table 3).

In six of the 21 patients anaerobic organisms only were isolated from the anterior urethra, but only one of these (patient No. 11) developed a urinary tract infection (*P. mirabilis*) following the isolation of anaerobic streptococcus only from the anterior urethra. In the remaining 15 patients in whom single or multiple gram negative organisms were isolated from the anterior urethra, 10 patients (67%), developed a post-operative urinary tract infection of which

Table 3. Positive post-operative bacteriological findings in 11 patients with a negative pre-operative urine culture

No	Urethral Swab Culture	Operative Urine Culture	Post-operative Urine Culture
1	<i>P. mirabilis</i>	<i>P. mirabilis</i>	<i>P. mirabilis</i>
2	<i>E. coli</i>	<i>E. coli</i>	<i>E. coli</i>
3	<i>P. aeruginosa</i>	—	<i>P. aeruginosa</i>
4	<i>E. coli</i>	<i>E. coli</i>	<i>E. coli</i>
5	<i>E. coli</i>	<i>P. aeruginosa</i>	<i>E. coli</i>
6	<i>P. mirabilis</i> <i>E. coli</i>	—	<i>P. mirabilis</i>
7	<i>P. mirabilis</i>	—	<i>P. mirabilis</i>
8	<i>P. mirabilis</i>	—	<i>P. mirabilis</i>
9	<i>Alpha. haemolytic streptococcus</i>	—	<i>E. coli</i>
10	<i>Staph. aureus</i>	—	<i>E. coli</i>
11	<i>Anaerobic streptococcus</i>	—	<i>P. mirabilis</i>

in two cases (Nos. 9 and 10) the subsequent urinary tract organisms bore no relationship to the urethral organisms isolated. Thus in 15 patients in whom urinary pathogens were isolated from the anterior urethra, eight (53%) developed a post-operative urinary tract infection with identical organisms.

In the four patients with a significant culture from the urine obtained at operation, three (Nos. 1, 2 and 4) grew organisms identical to those found in the urethral swab and post-operative urine. In the remaining patient (No. 5), *P. aeruginosa* was isolated from the urine at operation, whilst *E. coli* was isolated from both the urethral swab and post-operative urine culture.

From the above results it appears that a significant relationship exists between a positive urethral swab culture and subsequent development of a post-operative urinary tract infection ($p < 0.01$).

In both groups the urine specimens obtained at operation had no significant relationship to the organism isolated from either the urethral swab or the subsequent post-operative urinary tract infection. Similarly the presence of anaerobic organisms in the urethral culture has little effect upon the subsequent urine culture.

Discussion

From the results obtained it appears that the development of post-operative urinary tract infection in patients undergoing transurethral surgery is related to the presence of gram negative organisms in the anterior urethra either along ($p < 0.01$) or in conjunction with a positive pre-operative urine culture ($p < 0.01$).

In assessing the need for antibiotic prophylaxis in patients undergoing transurethral surgery, 2 facts have emerged;

firstly, antibiotic therapy should be given to all patients with pre-operative infected urine, and secondly, the incidence of post-operative infections progressively rises with the duration of post-operative catheter drainage [3, 8].

The role of antibiotics in patients with sterile pre-operative urine remains controversial [3, 4, 8]. In these patients, a post-operative urinary tract infection occurs in 15–45% of patients [4, 5, 7, 9] and evidence for antibiotic prophylaxis is conflicting [6].

Documented studies have shown both a significant reduction in the post-operative urinary tract infection rates [7, 9], or have failed to show any benefit [5, 6]; and extensive reviews of the subject have failed to clarify the role of antibiotic prophylaxis [3, 4, 8]. Clearly with a significant proportion of patients developing urinary tract infections, and the confusing role of antibiotic prophylaxis, the identification of possible "at risk" group would be of value.

The presence of organisms in the anterior urethra is considered to be due to contamination of the urethra by gut flora, and thought to be unrelated to the presence of organisms in the urine [1, 2]. In a proportion of patients, the presence of a gram negative pathogen in the anterior urethra is related to the subsequent development of a post-operative urinary tract infection, with identical organisms being isolated from both the urine and anterior urethra. As noted in previous studies, anaerobic organisms in the anterior urethra are contaminants, and have little relationship to the development of a post-operative urinary tract infection [1, 2].

In summary, of 36 patients with sterile pre-operative urine, 15 (42%) had a pathogenic gram negative organism isolated from the anterior urethra, 11 (31%) developed a post-operative urinary tract infection following removal of the catheter. Eight of the 11 patients (73%) had identical organisms isolated from both the urethral swab and post-operative urine, and a further 3 patients developed a urinary tract infection that differed from the urethral culture.

It may be proposed that in patients with a sterile pre-operative urine the presence of pathogenic organism in the anterior urethra, may represent an "at risk" group and these patients would benefit from peri-operative prophylaxis and a routine pre-operative urethral swab would help to identify these patients.

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H. J. Lewi
Department of Urology
Royal Infirmary
Glasgow G31 2ER
UK