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CATHETER-ASSOCIATED URINARY TRACT INFECTIONS IN PATIENTS UNDERGOING TRANSURETHRAL SURGERY

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A study of 75 patients undergoing transurethral surgery with relatively short-term urethral catheterization with a sterile closed gravity drainage system revealed a 72% over-all incidence of negative urine cultures after catheter removal. The combination of prophylactic use of antimicrobials and a standardized catheter care system is valuable for preventing catheter-associated bacteriuria.

Key words: Catheter, Urinary tract infection, TUR

The urinary catheter has been established as an essential instrument in the practice of modern medical diagnosis and treatment[1]. Emphasis has shifted from the controversy over the merits of the indwelling urethral catheter[2] toward methods and techniques of preventing catheter-associated urinary tract infections[3].

Several methods of management have been advanced to reduce the incidence of urinary infection after transurethral surgery. They include the prophylactic use of antibiotics[4], autoirrigation diuretics[5], and antimicrobial irrigation through indwelling urethral catheters[6]. Most surgeons now use closed catheter drainage with careful aseptic management. Herein are reported patients undergoing 2 kinds of transurethral surgery with relatively short-term urethral catheterization in an effort to determine the over-all incidence of catheter-associated bacteriuria and the value of prophylactic antimicrobials in preventing catheter-associated bacteriuria.

MATERIALS AND METHODS

The subjects were patients who had had a transurethral prostatectomy (group 1) or transurethral resection of bladder tumor (group 2) between January, 1985 and May, 1986.

Group 1 consisted of 41 patients who had had transurethral prostatectomy. The patients were between 60 and 87 years old. Operations were carried out by three surgeons, and 22 or 24F hemostatic Foley urethral catheters were inserted under sterile conditions at the end of the operation. Closed bladder drainage was used, and continuous bladder irrigation with normal saline was maintained for the first postoperative day. Prostatic chip were examined histologically. Catheters in this group remained indwelling from 2 to 7 days but usually from 3 to 5 days.

Group 2 consisted of 34 patients who had had transurethral resection of bladder tumor. The patients were between 48 and 80 years old. Operations were performed by one surgeon. A 22 or 24F hemostatic Foley urethral catheter was attached to a sterile gravity closed drainage system at the termination of the procedure. Irrigation by hand was performed only if necessiated by the occurrence of clots. Catheters remained indwelling from 2 to 6 days but generally for 3 days.

Urine cultures were obtained preoperatively, postoperatively while the catheters remained indwelling and postoperatively following removal of the catheter and prior to discharge from the hospital. The

specimens were collected by means of a sterile needle and syringe from the catheter sampling port after cleansing with a 70% isopropylalchohol swab. Catheter urine cultures were considered positive if greater than 10^5 organisms per ml were cultured.

Catheter care on the ward for male patients consisted of covering the meatus with povidone iodine ointment, which in turn was covered with a sterile gauze attached to the penile shaft and to the catheter shaft by means of paper tape. This dressing was changed twice daily. In female patients the meatus and area around the catheter were cleansed twice daily with 0.02% chlorhexidine gluconate.

RESULTS

Group 1: Twelve patients who had a negative initial urine culture were not treated with antimicrobials during catheterization. After the catheter was removed 6 of these patients (50%) had a positive urine culture. Of the 10 patients with a positive urine culture prior to catheterization and who were treated with antimicrobials during catheterization, 3 patients (30.0%) had a positive urine culture after removal of the catheter. Of the 19 patients with negative initial urine cultures but who were treated with antimicrobials during catheterization, 2 patients (10.5%) had a positive urine culture after removal of the catheter. The incidence of catheter-associated bacteriuria in group 1 was 26.8%.

Group 2: Fifteen patients who had a negative initial urine culture were not treated with antimicrobials during catheterization. After the catheter was removed, 5 of these patients (33.3%) had a positive urine culture. Of the 7 patients with a positive urine culture prior to catheterization and who were treated with antimicrobials during catheterization, 2 patients (28.6%) had a positive urine culture after removal of the catheter. Of the 12 patients with initial negative urine cultures but who were treated with antimicrobials during catheterization, 3 patients (25.0%) had a positive urine culture after removal of the catheter. The incidence of catheter-associated bacteriuria in group 2 was 29.4 %. Statistical analysis by the (chi-square test), gave a $p>0.05$ for the two compared groups (26.8% versus 29.4%); there was no significant difference between the two groups. The over-all incidence of bacteriuria after removal of the catheter was 28%, that is 21 positive cultures in 75 patients (Table 1). For the 31 patients with a negative initial urine culture in the two groups who were treated with antimicrobials prophylactically (Table 2), the incidence of bacteriuria following removal of the catheter was 16.1 % (5 of 31 patients), which was significantly higher than the 40.7% for the patients with a negative initial urine culture and who were not treated with antimicrobials, ($p<0.05$). Antimicrobial agents used in these patients included cefmenoxime, cefoperazone, cefotetan, latamoxef and ticarcillin.

Table 1. Over-all incidence of bacteriuria after short-term catheterization. Over-all totals···21 positive cultures in 75 patients (28 per cent over-all incidence of catheter-associated bacteriuria).

	Total Pts.	Culture after Catheter Removal	
		Neg.	Pos.
Initial negative urine culture and not treated with antimicrobials:			
Group 1. TUR-P	12	6	6
Group 2. TUR-BT	15	10	5
Positive culture prior to catheterization (treated with antimicrobials):			
Group 1. TUR-P	10	7	3
Group 2. TUR-BT	7	5	2
Initial negative urine culture but antimicrobials used during catheterization:			
Group 1. TUR-P	19	17	2
Group 2. TUR-BT	12	9	3
Totals	75	54	21

Table 2. Value of prophylactic antimicrobials in patients with initial negative urine cultures.

	Total pts.	Pts. with Positive Cultures After Catheter Removal	
		No.	(%)
No antimicrobials used (groups 1-2)	27	11	(40.7)
Antimicrobials used prophylactically (groups 1-2)	31	5	(16.1)

Table 3. Organisms isolated from positive urine cultures.

Organism	Group 1 (11 pts.)	Group 2 (10 pts.)	Totals
E. coli	8	4	12
Klebsiella pneumoniae	2	3	5
Proteus mirabilis		2	2
Enterococcus	3		3
Serratia marcescens		1	1
Staphylococcus aureus	1		1
Staphylococcus epidermidis	1		1
Pseudomonas aeruginosa	2	3	5
Enterobacter cloacae		1	1
Citrobacter freundii		1	1
Totals	17	15	32

Cefmenoxime and latamoxef were the most frequently used. Table 3 shows the organisms isolated from positive urine cultures in each group following catheter removal.

DISCUSSION

The use of systemic antimicrobials during catheterization remains prevalent, especially among the transurethral prostatectomy patients. Among 58 patients in the two groups with initial negative urine cultures, 31 patients (53.4%) were treated with such medications prophylactically. According to Kunin, almost all investigators agree that prophylactic systemic antimicrobial therapy is of little value except in special circumstances[7]. The transurethral prostatectomy certainly represents such a special circumstance wherein antimicrobial agents are often used to prevent bacteremia and sepsis during the operative and postoperative periods[8]. Our findings of a significantly lower incidence of catheter-associated bacteriuria with chemoprophylaxis in these patients (Table 2) is in agreement with the findings of Plorde and Lacy and their associates[4,9]. Thus, for short-term catheterization in prostatectomy patients with a negative initial urine culture the use of prophylactic antimicrobials appears to be beneficial. For patients with a positive initial urine culture, appropriate antibiotic therapy should be used.

The 28% over-all incidence of catheter-associated bacteriuria (Table 1) indicates that there is still room for considerable improvement. Nonetheless, this indicates that approximately 72% of the patients subjected to urethral catheterization were free of bacteriuria following removal of the catheter. This is considerably better than the previously quoted incidence of 100% when open catheter drainage systems were used[10].

It is difficult to evaluate the efficacy of a catheter care system since many variable factors are involved in catheter-associated bacteriuria. Certainly the general condition of the patient is important. Catheterization in sick and elderty patients is associated with a greater hazard of infection[11].

A second significant factor is the technique of catheter insertion. In our patients the catheters were all inserted in the operating room under sterile conditions. However, an uncontrolled factor is contamination of the bladder with urethral flora introduced during insertion of the catheter.

A third important factor in determining the final result is the type of drainage system used. Probably the greatest single advance in preventing catheter-induced infection has been the introduction of the sterile closed gravity drainage system[12]. Other attempts to lower the incidence of infection following catheterization include the use of antibiotic lubricants and impregnated catheters and prophylactic irrigations in a closed system with polymyxin solutions. None of these techniques were used in our patients.

The use of systemic antimicrobials is another variable which has been considered in some detail in the differential analysis of our data. Of further importance is the duration of catheterization. If a catheter is left indwelling long enough, a nearly 100% incidence of bacteriuria ensues[7]. For this reason, we used relatively short-term catheterization in all the patients studied here. Gordon et al.[13] found that catheter removal without antibiotics resulted in spontaneous resolution of *Staphylococcus epidermidis* bacteriuria but that other organisms persisted in the urine after catheter removal. Accordingly, the small risk of urinary tract infection may be avoided by repeating the urine culture and, if necessary, covering with one or two

doses of an appropriate antibiotic. Finally the catheter care system on the ward must be considered. By using the currently available techniques, a 95% incidence of negative culture following short-term catheterization should be possible[14]. Breaks in catheter care techniques are probably responsible for most of the infections in these patients.

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和文抄録

経尿道的手術患者における留置カテーテルによる尿路感染症

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経尿道手術を受け，術後無菌的な閉鎖式ドレナージによる比較的短期間の尿道カテーテル留置が行なわれた75人の患者について検討した．これらのうち，72%がカテーテル抜去後尿培養陰性を示した．カテーテル留置に伴う細菌尿をさらに効果的に予防するためには，予防的な抗生剤の使用と，標準化されたカテーテル管理体制の併用の必要性が示唆される．

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