RECONSTRUCTIVE UROLOGIC SURGERY
Pediatric and Adult

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LEONARD ZINMAN, M.D.
editors

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Dedicated to
Our parents and wives
Mary Jo, Roberta, and Helen
who made this
endeavor possible

Preface

During the past 25 years, the reconstructive aspects of urologic surgery have emerged and become a major component of our surgical specialty. In this period of time, the ileal conduit, renovascular reconstruction, renal transplantation, and many pediatric reconstructive procedures have been added to our surgical armamentarium.

The purpose of this book is to present the major pediatric and adult reconstructive surgical procedures available today. The technical aspects of reconstructive urologic surgery will be the major focus of this heavily illustrated volume. Since no one individual can be an authority on every aspect of reconstructive urologic surgery, recognized authorities from this country and abroad have enthusiastically collaborated to produce this textbook, which is the outgrowth of a postgraduate symposium held at the Lahey Clinic Foundation.

We hope this book will provide the experienced practitioner of urology and the resident in training with techniques that can be incorporated into their surgical practice. Hopefully it will also act as a catalyst for further surgical innovation and ultimately render this work obsolete.

John A. Libertino
Leonard Zinman

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Chapter ONE

Treatment of Bacterial Urinary Tract Infections Associated with Urologic Surgery

Edward J. McGuire, M.D.

Bacterial colonization of the urinary tract is frequently found in patients undergoing major urologic surgical procedures. In such patients, bacteriuria may be chronic before operation or may occur in relation to the operative procedure. The significance of bacteriuria varies with the clinical circumstances in which it occurs; in some patients the risk may be small, but in others urinary infection may pose a threat to a successful surgical procedure or even a hazard to life. Ideally, antimicrobial treatment should result in permanent eradication of bacteriuria, and, in some patients, surgical correction of an anatomic or functional urinary disorder may enable this result. However, in others, treatment goals may more realistically be limited to the prevention of bacterial tissue or vascular invasion. While host factors are important, a working knowledge of the bacteriology of the organisms commonly associated with urinary tract infection and of the antimicrobial agents employed in their treatment is helpful in attaining a satisfactory clinical result.

BACTERIOLOGY OF URINARY TRACT INFECTIONS

Organisms, which commonly infect the urinary tract, can arbitrarily be grouped by antibacterial sensitivity patterns and by the clinical settings which favor colonization by a particular organism or group of organisms. Most urinary infections acquired outside the hospital are caused by three organisms: Escherichia coli, Proteus mirabilis, and the enterococci. They are generally penicillin sensitive, although E coli infections acquired in the hospital are less likely to respond to therapy than those encountered in domiciliary practice (76% of 855 Yale-New Haven Hospital isolates in the first quarter of 1975). Proteus mirabilis, a urease-producing organism, is frequently associated with struvite calculi. In the presence of these calculi, persistent bacteriuria may occur with essentially

static antibacterial sensitivity patterns despite multiple courses of antimicrobial therapy (28). The enterococci, gram-variable organisms, show important differences in response to the usual urinary antimicrobial agents; they are sensitive to the penicillins and occasionally to erythromycin and furadantin but frequently resistant to carbenicillin, gentamicin, nalidixic acid, and the cephalosporins. Common antimicrobial sensitivity patterns for this group of organisms are given in Table 1.1.

The second group of urinary tract organisms occur largely in hospitalized patients, in patients with structural or functional urinary tract abnormalities, or in patients previously treated with antimicrobial agents. Klebsiella, Enterobacteriaceae, indole-positive Proteus species (morganii, vulgris, and rettgeri), and occasionally other organisms, some of which were previously grouped as the "Paracolons," comprise this group. Some strains of Klebsiella are urea splitting and are also associated with formation of struvite calculi. Klebsiella is frequently associated with superinfections in hospitalized patients previously treated with antimicrobial agents (31). The organism is often sensitive to the cephalosporins. Enterobacteriaceae is generally not sensitive either to penicillin or the cephalosporins. Typical antimicrobial sensitivity patterns for this group of organisms are given in Table 1.2.

Pseudomonas and Serratia urinary infections occur in patients with structural or functional abnormalities of the urinary tract, long-term catheter drainage, ileal conduit urinary diversions, and in patients with infected calculi, as both organisms may be urease producing. These organisms are distinguished by an insensitivity to most antimicrobial agents without dose-related toxicity. However, carbenicillin may be useful for both Pseudomonas and Serratia infections (80% of Yale-New Haven Hospital Serratia isolates in the first quarter of 1975) and oxytetracycline may be effective in Pseudomonas infections (35). Some evidence has shown that bacteremia resulting from this highly resistant group of organisms is more difficult to treat successfully than similar conditions resulting from E coli infections (15) (Table 1.3).

TABLE 1.1
Percent of Group 1 Isolates Sensitive to Various Antimicrobials*

	E coli	Proteus Mirabilis	Entero-cocci
Number of isolates	855	212	575
Ampicillin	76	98	100
Cephalosporin	80	96	N**
Sulfamethoxazole-Trimethoprim	86	84	N**
Kanamycin	98	96	...
Gentamicin	100	98	...
Carbenicillin	80	98	...
Nalidixic acid	99	99	...
Tetracycline	70	N**	...
Nitrofurantoin	90	80	...

* Kirby-Bauer method.
** N = 30% or less.

ANTIMICROBIAL AGENTS AND SENSITIVITY TESTING

The content of an antimicrobial agent in commercially available sensitivity disks is such that diffusion of the material onto the agar plate results in a concentration of antibiotic which approximates an ideal level in the serum except in the case of nalidixic acid or nitrofurantoin. Considerable evidence exists that concentrations in urine, and not in serum, are of critical importance in the ultimate response of urinary tract infections to antimicrobial agents (22, 34). This suggests that disk sensitivity testing may underestimate efficacy of antimicrobial agents with greater concentration in urine than in serum and is particularly true with the cephalosporins and ampicillin. Conversely, chloromycetin is approximately 80% detoxified in the liver, and a significant percent is excreted in the urine as an inactive metabolite, which reduces its efficacy in urinary tract infections particularly in patients with impaired renal function. Moreover, since the concentration of antibiotic in the urine is critical to the ultimate prognosis of curing urinary infection, inadequate renal function may limit the effectiveness of treatment with any antimicrobial agent. Cure of urinary tract infection in an anephric patient or a patient with vir-

TABLE 1.2
Percent of Group 2 Isolates Sensitive to Various Antimicrobials*

	Enterobacter	Klebsiella	Proteus (Indole +)	Citrobacter
Number of isolates	200	318	75	50
Ampicillin	N**	N**	N**	N**
Cephalosporin	N**	88	N**	N**
Sulfamethoxazole-Trimethoprim	26	N**	N**	N**
Kanamycin	95	95	100	90
Gentamicin	99	100	100	100
Carbenicillin	86	N**	E†	N**
Nalidixic acid	95	95	100	100
Tetracycline	92	93	E†	90
Nitrofurantoin	30	28	N**	88

* Kirby-Bauer method.
** N = 30% or less.
† E = 30 to 50%.

TABLE 1.3
Percent of Group 3 Isolates Sensitive to Various Antimicrobials*

	Pseudomonas	Serratia
Number of isolates	217	41
Tetracycline	N**	N**
Kanamycin	N**	88
Gentamicin	97	100
Nalidixic acid	N**	95
Carbenicillin	92	90

* Kirby-Bauer method.
** N = 30% or less.

tually no renal function may be impossible except by direct instillation of an antimicrobial agent into the urinary tract.

ANTIMICROBIAL AGENTS

Oral Agents with No Useful Serum Activity

Sulfonamides. These agents are useful in infections acquired outside the hospital but are of limited use in surgical patients. Sulfonamide administration is associated with rapid changes in the intestinal flora, presumably the pool of organisms from which superinfections occur. Most infections acquired in the hospital are not reliably susceptible to these agents.

Nalidixic Acid. Commercially available nalidixic acid disks for sensitivity tests result in concentrations on the agar plate which approximate those achievable in the urine. Reports (6) of the rapid emergence of resistant organisms during treatment have recently been disputed. A 10-year study of the sensitivity of urinary pathogens to nalidixic acid in a pyelonephritic unit showed essentially identical results at the beginning and termination of the study. Fecal excretion is minimal, and the intestinal flora remains fairly stable during long-term treatment (2). However, clinical response to the agent may vary, and its applicability in surgical patients should be limited to circumstances in which closed urinary drainage is achieved or can be achieved within a short period after the initiation of treatment, providing ideal conditions for antimicrobial therapy.

Methanamine Salts. Antibacterial activity of methanamine salts is dependent upon release of formaldehyde in the presence of an acid urine (pH, 5.5 or less). They are ineffective in the treatment of infections with urease-positive organisms because of the inability to achieve a truly acid urine. These include infections with certain Proteus species, Klebsiella species, Pseudomonas, and, occasionally, Serratia species. Applicability in surgical patients is limited.

Nitrofurantoin. Sensitivity patterns to nitrofurantoin have remained stable over a long period of time. There is no effective level of the antibiotic in serum, but the agent is concentrated in renal lymphatic tissue. In general, the range of sensitive bacteria is too small for widespread use in patients undergoing major surgical procedures with complicated urinary infections.

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