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UROLOGY BOARD REVIEW MANUAL

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Urinary Lithiasis

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Urinary Lithiasis

INTRODUCTION

Urinary stones are an ancient phenomenon, found in an Egyptian skeleton approximately 7000 years old. Hippocrates ascribed stones to the ingestion of muddy river water and lime. Galen recognized etiologic factors such as heredity, race, alcohol consumption, and joint disease.

The early 20th century saw advances in understanding of the etiology, chemistry, and bacteriology of various stones, and surgical techniques advanced to a point of relative safety for the patient. The metabolic basis of urinary calculi has been elucidated in the past 30 years, and biochemical etiologic factors can be found in over 95% of stone-forming patients. Medical therapy has developed to a point where appropriate therapy can decrease the expected recurrence rate in a stone-forming population of patients by as much as 90%. Surgical treatment of stones in the kidneys and upper ureters by open incision was necessary until about 1980, whereas lower ureteral stones could be treated to some extent by blind endoscopic procedures, with a success rate of about 80% in appropriately selected patients. The development of extracorporeal shock wave lithotripsy (ESWL), nephroscopy, and small caliber ureteroscopes (both rigid and flexible) has changed the surgical therapy for urolithiasis to the point where it is now rare to perform open surgery for this disease.

This review highlights the modern metabolic approach to stone disease, and the different medical and surgical treatment options for individual cases.

EPIDEMIOLOGY

The prevalence of urinary lithiasis in the U.S. population is about 10%.¹ The lifetime risk is 20% for Caucasian men and about 7% for women, regardless of race.¹ The risk among African American men is about one third the

risk among Caucasians. Staghorn calculi occur about twice as often in women as in men due to their association with recurrent urinary tract infection. The annual incidence of urinary calculi is about 1% in the Caucasian male population, principally in those between age 20 and 50 years, with the first episode occurring in the third decade of life. The incidence in summer months is about twice that in winter months. Geographic variations in incidence are well known, with the largest incidence in the United States occurring in the Southeast, particularly in Virginia and the Carolinas, where the incidence is 3 to 4 times higher than in the rest of the country. The incidence is lower in the mountain and desert states (ie, Nevada, Utah, Wyoming, Colorado, Idaho).

The lifetime recurrence rate for urinary stones has been estimated to be between 50% and 80%, with about 10% of recurrences within the first year and an annual rate of 3% to 4% thereafter.² The incidence of upper tract stone disease seems to be increasing, whereas the incidence of bladder stones has decreased in developed countries. These trends may be due to higher dietary protein and sugar intake with prosperity. The incidence of stones decreased during World War I and World War II. The incidence in desert troops was high.

In the United States, 70% of urinary calculi are primarily composed of calcium oxalate; half of these are pure and half are a mixture with calcium phosphate. About 6% to 10% are pure calcium phosphate, 10% to 15% are magnesium ammonium phosphate, 8% are uric acid, and 1% to 3% are cystine.³

FACTORS UNDERLYING URINARY CALCULUS FORMATION

PHYSICAL CHEMISTRY

Precipitation of a salt in solution occurs when the *relative supersaturation* is greater than 1. Relative supersaturation is the ratio of the activity product of the ions