

# CURRENT MANAGEMENT OF UROLITHIASIS IN CHILDREN

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## INTRODUCTION

Two to 3% of all patients of urolithiasis are children. Pediatric urolithiasis is endemic in developing countries including India. An underlying metabolic disorder is the cause in about half of children, infection being the cause in the other half. In Uttar Pradesh, parts of Gujrat and Maharashtra, vesical calculi are very frequent. This is attributed to dietary cereals being the predominant source of proteins. Structural urinary tract malformations predispose to stones because of "obstruction-stasis-infection" relationship. Urinary reconstructions using intestines or hair bearing skin predisposes to stone disease.

## EPIDEMIOLOGY

The mean age of presentation is 6.9 years for girls and 5.2 years for boys. Infected stones generally present early before 4 years of age. Recurrence rates range from 3.6% to 68% and is the highest for children with metabolic risk factors. Endemic vesical calculi mostly affect boys between 1-5 years. In this group metabolic abnormalities are seldom detected and the recurrence rate is low.

## CLASSIFICATION

The following is the classification proposed by Smith and Segura:

### Renal Calculus Formation

#### Enzyme disorders

- Primary hyperoxaluria (deficiency of hepatic enzyme)
- 1,8-Dihydroxyadeninuria
- Lesch—Nyhan syndrome

#### Renal tubular syndromes

- Cystinuria
- Renal tubular acidosis (types 1-4) (calcium phosphate stones)

#### Hypercalcemic states

- Hyperparathyroidism
- Immobilization

#### Uric acid lithiasis

#### Enteric urolithiasis

#### Idiopathic calcium oxalate urolithiasis

#### Solute excess:

- Hypercalciuria
- Hyperoxaluria
- Hyperuricosuria
- Hypocitraturia
- Medications excreted into the urine

## Endemic bladder stone formation

### Secondary urolithiasis

- Infection (struvite stones, secondary to UTI with bacteria that produce urease)
- Obstruction (PUJ, VUJ, Neurogenic bladder, diverticulum)
- Bladder augmentation with intestines (mucus provides nidus, chronic bacteriuria contributes)
- Foreign body (ureteral stents, remnants of catheters, suture, etc.)

## PATHOPHYSIOLOGY

Urinary calculi consist of crystalline and matrix components. Matrix, a gelatinous glycoprotein, forms the predominant feature of infective stones. Matrix also accounts for the softness of such stones. On the other hand metabolic stones such as xanthine and cystine are predominantly crystalline and accordingly hard. Lithogenesis is a complex physical process involving supersaturation of lithogenic ions and crystallization of compound in the urine. The process is influenced by *urinary dilution*, *pH*, and the presence of urinary ions or compounds that function as promoters or inhibitors of crystallization. Spontaneous nucleation takes place because of supersaturation of compounds. Secondary nucleation occurs on cellular debris and other particles in the urine. A damaged uro-epithelium, following urinary tract infection, may provide a nidus on which crystal growth occurs (heterogenous nucleation). An acidic ( $\text{pH} < 6$ ) urine increases the solubility of calcium phosphate and a pH between 6 and 7, that of uric acid. An alkaline pH helps to keep cystine in solution. The formation of calcium oxalate is independent of changes in pH. Urinary tract infection with urea splitting organisms such as *Proteus* is also an important factor for precipitation of ammonium salts. *Anatomical abnormalities* such as reflux, diverticulae etc produce stasis thereby encouraging precipitation of lithogenic compounds. Infective stones have a soft glycoprotein matrix on which inorganic constituents such as magnesium ammonium phosphate, ammonium phosphate and calcium phosphate deposit. Only calcified stones are radio-opaque. Stag horn calculus is an infective calculus that grows into the configuration of the renal pelvis and calyces. Occasionally it progresses to the entire kidney parenchyma to produce an inflammatory mass – xanthogranulomatous pyelonephritis.

## CLINICAL FEATURES

Flank pain, urinary infection and hematuria are predominant features of renal stones. Radiating pain from loin to groin is a typical feature of ureteric stone. Vesical stones present as lower urinary tract symptoms, stranguary and retention. Small vesical stones may get