Nephrolithiasis in Children

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ABSTRACT

A study of 100 cases of nephrolithiasis between 3 to 15 years of age is reported. Seventy four cases were more than 10 years old. The common presenting symptoms included abdominal pain (69%), burning micturition (23%), gross hematuria (4%) and unexplained pyrexia (6%). Associated urinary tract malformations were found in 16 cases. Twenty four had struvite calculi. Urinary infection with Proteus mirabilis was found in 23 children and idiopathic hypercalciuria in 31 cases. Following surgical removal, either percutaneously or by open surgery, 8 patients had residual calculi and in 6 cases recurrence occurred.

Key words: *Urolithiasis, Struvite stones, Idiopathic hypercalciuria.*

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Received for publication: April 16, 1992; Accepted: June 23, 1992

Urolithiasis in children accounts for 6% of total admissions at the Urology Research Centre, Jaipur. We report the clinical profile and outcome in 100 children with nephrolithiasis observed at this Centre over a period of 4 years and 4 months.

Material and Methods

This study includes 100 children of nephrolithiasis admitted to Urology Research Centre, S.M.S. Medical College Hospital, Jaipur during August, 1987 to December, 1991. Only those patients who had renal calculi, were completely evaluated and underwent surgery were included in this study. Those patients who had exclusively lower tract calculi, patients taking drugs known to form stones, *e.g.*, thiazides, allopurinol, vitamin D, *etc.*, and patients who were not operated upon were excluded.

A detailed clinical profile was recorded in each case. Investigative workup included urinary pH, specific gravity and microscopic examination. Urine culture was carried out in every case. Urinary creatinine, 24 hours urinary calcium and uric acid excretion was estimated. Blood urea, serum creatinine, uric acid, calcium, phosphorus, electrolytes and total proteins were also obtained. *X*-ray of kidney-ureter-bladder region was done. Intravenous urogram was obtained in every case whose renal function was normal. Ultrasonography was done in patients with abnormal renal functions, poorly visualized system on intravenous urogram and in cases where radiolucent stone was suspected. In cases of nonvisualization of kidney or doubtful primary upper tract obstruction, Technitium 99 m diethylene triamine pentaacetic acid (Tc^{99} DTPA) isotope studies were done to assess the function and site of

obstruction. Recovered stones after surgery, were analyzed by qualitative chemical analysis for their chemical composition.

Hypercalciuria was defined as excretion of more than 4 mg/kg body weight/day of calcium in urine(1). Idiopathic hypercalciuria refers to a syndrome of unestablished etiology comprising hypercalciuria in the presence of normocalcemia(1). Calcium loading test was not performed.

Infection induced stones are caused by urea splitting organisms. Patients were considered to have infection stones if calculi were composed primarily of: (*i*) magnesium ammonium phosphate(2), (*ii*) Calcium phosphate(2), (*iii*) matrix(3), and (*iv*) Calcium phosphate containing mix stones when urine culture showed presence of urease producing organism.

The calculi were removed by various surgical procedures including percutaneous nephrolithotomy, pyelolithotomy, pyelolithotomy with ureterolithotomy, pyeloplasty with removal of kidney stones and nephrectomy.

Results

Of the 100 cases with nephrolithiasis 32 had multiple renal calculi (*Figs. 1 & 2*) while 20 patients had bilateral renal calculi. Twelve patients had associated ureteric calculi. The mean age was 10.2 years (range 3-15 years), 74 children were between 10-14 years of age. Seventy seven were boys and 23 girls.

Presenting symptoms were abdominal pain (69%) burning micturition (23%), gross hematuria (4%), nausea and vomiting (16%). Nine cases had palpable kidneys and 6 had unexplained fever. Urine culture showed evidence of infection in 56 cases. The commonest organism grown was *Proteus mirabilis* in 23 cases. Radio-opaque stones were seen on plain radiographs in almost all (98%). The intravenous urogram showed underlying congenital structural abnormalities in 16 cases and variable degrees of hydronephrosis in 63 cases (*Fig. 3*). Seven cases had pelviureteric junction obstruction, 2 had horseshoe kidneys (*Fig. 4*) and duplex collecting system was present in 6 patients. One patient had bilateral hydroureteronephrosis in whom bilateral vesicoureteric reflux (Grade V) was diagnosed on voiding cystography. Two cases of radiolucent calculi were diagnosed by intravenous urography and ultrasonography.

In 99 patients, blood chemistry was normal. The patient with vesicoureteric reflux had 2.4 mg/dl serum creatinine. Seventy two patients showed more than 5 pus cells per high power field during microscopic examination of urine, 4 cases had gross and 79 cases had microscopic hema-

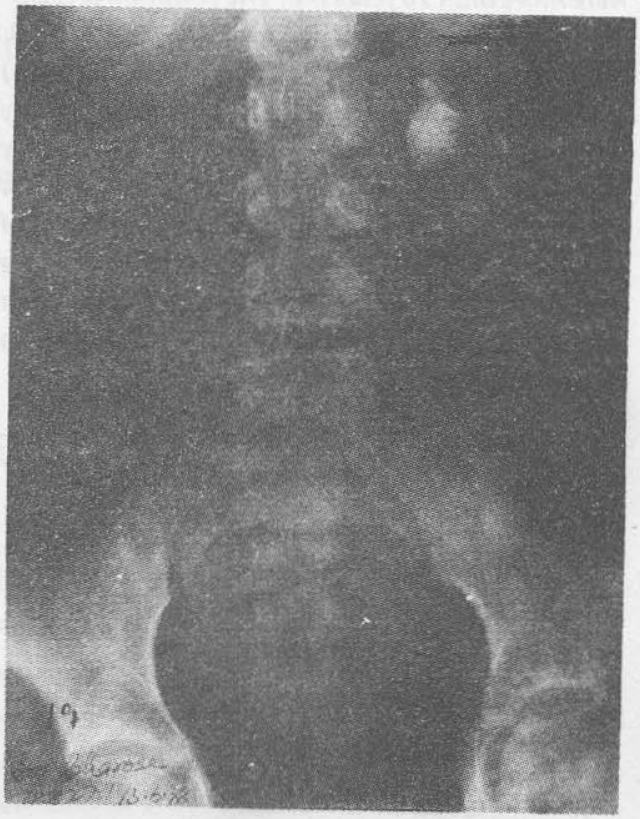

Fig. 1. Skiagram KUB region shows multiple right renal calculi.

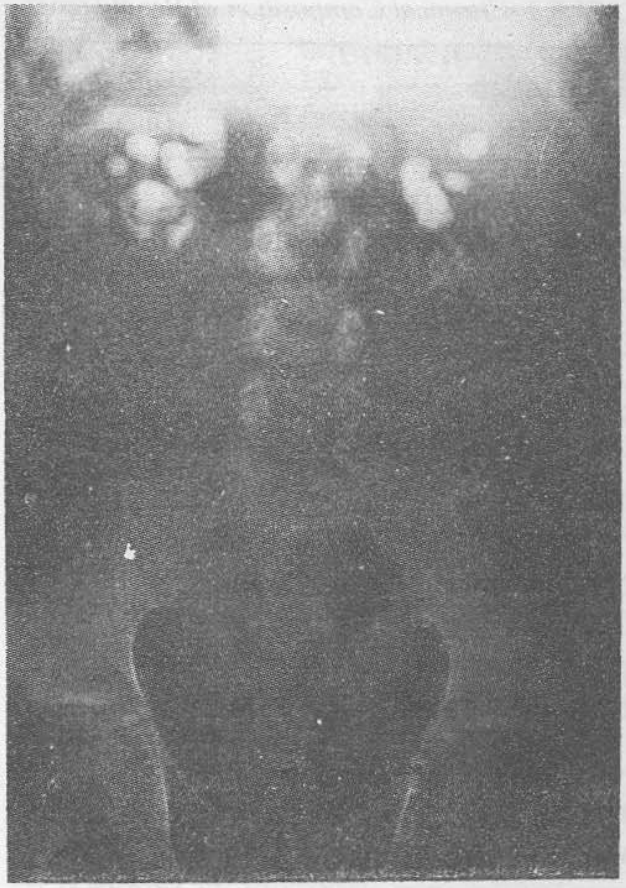

Fig. 2. Skiagram KUB shows multiple bilateral renal calculi.

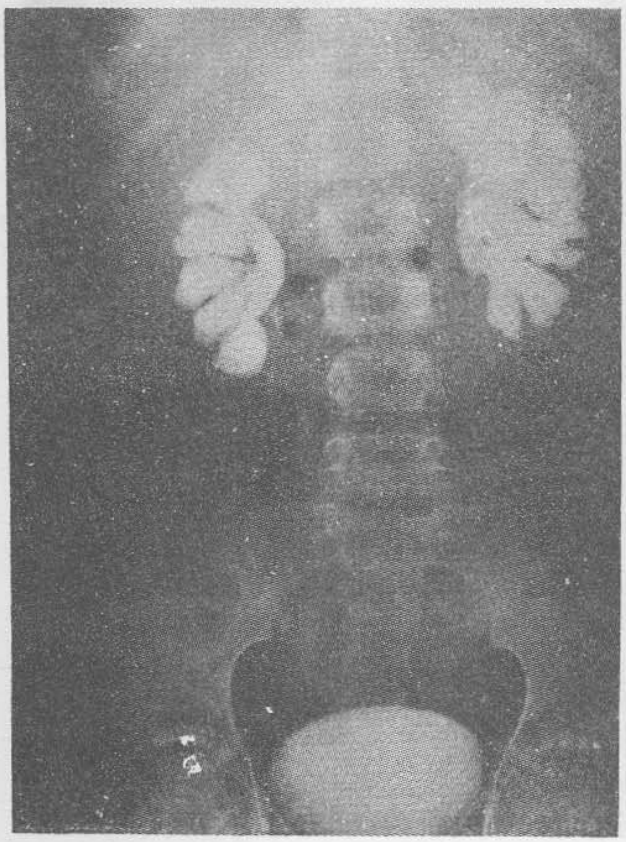

Fig. 3. IVU shows bilateral hydronephrosis.

turia. Idiopathic hypercalciuria was detected in 31 cases.

The operative procedures performed were percutaneous nephrolithotomy (PCNL) in 52 cases. PCNL was carried out on functioning kidney in the absence of associated upper tract anatomic abnormality that requires open surgical intervention. PCNL was not performed when for complete clearance of calculi multiple punctures were required. Other procedures performed were pyelolithotomy in 24 cases, pyelolithotomy with ureterolithotomy in 12 cases and pyelolithotomy with pyeloplasty in 7 cases. In 4 patients with renal calculi in non-functioning unit, nephrectomy was carried out. In one case having bilateral renal calculi with bilateral vesicoureteral reflux, bilateral percutaneous nephrolithostomy was done.

Results of Chemical analysis of stones are as shown in *Table I*. Important investigating findings and their relation with various types of stones are shown in *Table II*. Forty stones were infection stones chiefly, comprised of magnesium ammonium phosphate. In 31 idiopathic hypercalciuric patients, mainly calcium oxalate containing stones were found. No metabolic stone was detected in this series.

Residual calculi were seen in 8 patients, of which 3 were in those cases which were managed by pyelolithotomy and 5 were in those in whom percutaneous nephrolithotomy was done. Of the cases who had complete stone clearance of initial surgery, recurrency took place in 6 cases during a mean follow up of 11.8 months. Two patients died because of chronic renal failure, one had

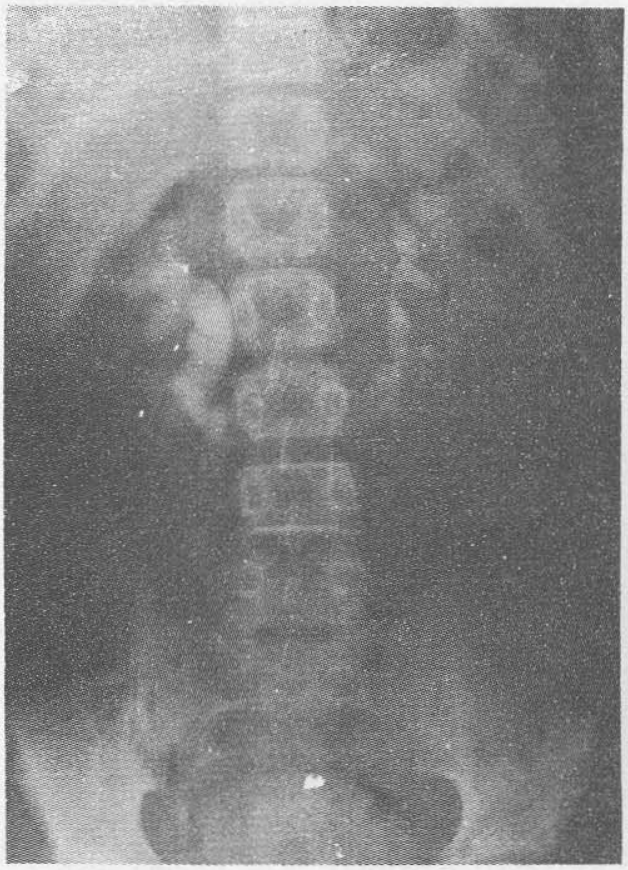

Fig. 4. Intravenous pyelogram shows 'Horse Shoe Kidney' with back pressure changes on right side.

bilateral infective renal calculi who subsequently developed unilateral recurrent renal calculi after 7 months. The probable cause of renal failure in that case was interstitial nephritis. Other had bilateral vesicoureteral reflux, renal calculi and poor renal function preoperatively.

Postoperatively depending on urine culture, antibiotics were given to the patients for maintenance of sterile urine, to prevent recurrence of infective stones. Plenty of fluids and low calcium diet was advised to patients with idiopathic hypercalciuria.

Discussion

In the present study, male to female ratio is 3.3 : 1 which is higher than the ratio

TABLE I–*Chemical Composition of Renal Stones*

Composition	No. of patients (n = 100)
Calcium oxalate and phosphate	35
Magnesium ammonium phosphate (struvite)	24
Calcium oxalate	21
Calcium phosphate	9
Uric acid and calcium oxalate	7
Matrix	4

of approximately 1 : 1 in different studies(4-6). In our data, 74% children were in the age group of 10-14 years which is comparably to earlier reports(7,8).

The presenting symptoms were pain abdomen in 69% cases which correlates well with the 66.6% incidence of pain abdomen as the primary symptom reported by others(5). Fifty six children had urinary tract infection as evidenced by urine culture. Different series report an incidence of infection ranging between 33 to 68%(5,9). Twenty two patients had associated magnesium ammonium phosphate stones.

The incidence of renal stone disease due to metabolic causes is rare in young children but this increases after the first decade of life. Thirty one per cent patients in our series had idiopathic hypercalciuria, whereas other series reported 20 to 30%(6,10) incidence of idiopathic hypercalciuria among children with renal calculi. Cases of idiopathic hypercalciuria should be kept on low calcium diet and high fluid intake. In a few cases, thiazide diuretics may be used to reduce hypercalciuria and prevent recurrence of calculi.

Percutaneous nephrolithotomy is a safe and effective method for the management

TABLE II–*Investigative Finding and Types of Stones*

Finding	No. of patients	Infective bacteria		Stone composition					
		Pm	Opm	OU	M	MT	O	P	S
1. Anatomic anomalies	16	4	8	1	4	-	4	3	4
2. Only infection present	44	19	25	-	13	4	3	6	18
3. Idiopathic hypercalciuria	31	-	-	6	15	-	10	0	-
4. No abnormalities	9	-	-		3	-	4	-	2
Total	100	23	33	7	35	4	21	9	24

Abbreviations:
Pm = *Proteus mirabilis*
OPm = Other than *Proteus mirabilis*
OU = Uric acid with calcium oxalate
M = Calcium oxalate and calcium phosphate
MT = Matrix
O = Calcium oxalate
P = Calcium phosphate
S = Magnesium ammonium phosphate

of renal and some upper ureteric calculi even in children. This procedure has minimal morbidity, mortality and shorter hospital stay. There is very low incidence of delayed complications with this technique(11,12).

REFERENCES

1. Polinsky MS, Kaiser BA, Baluarte HJ. Urolithiasis in childhood. Pediatr Clin North Am 1987, 34: 683-710.
2. Walther PC, Lamm D, Kaplan GW. Pediatric Urolithiasis: A ten year review. Pediatrics 1980, 65: 1068-1072.
3. Drach GW. Urinary lithiasis: Etiology diagnosis and medical management. *In:* Cambell's Urology. Eds Walsh PC, Retik AB, Stamey TA, Vaughan ED. Philadelphia, W.B. Saunders Company, 1992, pp 2085-2156.
4. Daeschner CW, Singleton EB, Curtis JC. Urinary tract calculi and nephrocalcinosis in infants and children. J Pediatr 1960, 57: 721-732.
5. Rizvi SA, Naqvi SA, Hussain Z, Shahjehan S. Renal stones in children in Pakistan. Br J Urol 1985, 57: 618-621.
6. Choi H, Snyder HM, Duckett JW. Urolithiasis in childhood ; Current management. J Pediatr Surg 1987, 22: 158-164.
7. Bapna BC, Rao DN, Singh SM. Nephrolithiasis in children. ICMR Tech Rept Ser 1971, 8: 79.

8. Malek RS, Kelalis PP. Pediatric nephrolithiasis. J Urol 1975, 113: 545.

9. Troup CW, Lawnicki CC, Bourne RB, Hodgson NB. Renal calculus in children. J Urol 1972, 107: 306-307.

10. Ghazali S, Barratt TM, Williams DI. Childhood urolithiasis in Britain. Arch Dis Child 1973, 48: 291.

11. Segura JW. Percutaneous management. *In:* Campbell's Urology. Eds Walsh PC, Retik AB, Stamey TGA, Vaughan ED. Philadelphia, W.B. Saunders Company, 1992, pp 2183-2194.

12. Roth RA, Beckmann CF. Complications of extracorporeal shock wave lithotripsy and percutaneous nephrolithotomy. Urol Clin North Am 1988, 15: 155-166.

Nephrocalcinosis in a Six-Week-Old Infant

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Nephrocalcinosis is being detected with increasing frequency in neonates and young infants. Various therapeutic strategies used in the care of preterms and very LBW babies such as long term furosemide therapy, calcium infusions and parenteral nutrition are some of the important reasons for the increased incidence of nephrocalcinosis in this age group(1-8).

However, in the absence of these adverse perinatal factors, nephrocalcinosis remains a rarity in young infants(4). We report a case of nephrocalcinosis and distal renal tubular acidosis (RTA) in a six-week-old infant.

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Received for publication: May 26, 1992;
Accepted: January 5, 1993

Case Report

A 6-week-old female infant presented with a history of failure to thrive and vomiting of 3 weeks duration and breathlessness since 4 days. She was born of a full-term normal delivery with a birth weight of 2.25 kg. The antenatal history was uneventful. There was no perinatal asphyxia, respiratory distress or medications. A previous female sibling had a similar history of failure to thrive and vomiting. Her urinalysis had revealed leucocyturia and she had been treated for sepsis. She had not been investigated further and had died at 10 weeks of age.

On examination the patient weighed 1.9 kg, had moderate dehydration and was tachypneic with a respiratory rate of 60 per minute. Her systemic examination was normal. Investigations revealed a hemoglobin level of 9 g/dl, WBC count of 7,600/μmm with neutrophils 36%, lymphocytes 63% and eosinophils 1%, platelets were adequate on smear. Urinalysis revealed trace albumin, absent sugar and 4-6 WBCs per high power