CASE REPORT

Nephrolithiasis in a newborn: a rare case and review of literature

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SUMMARY

Nephrolithiasis, although a common entity in adults, is less common in children and rare in newborns. The evaluation and management strategies of renal stones in neonates are unclear. We report a rare scenario of renal calculus in a newborn aged 3 days presenting with decreased urine output, fever and crying during micturition. Patient was thoroughly investigated and managed conservatively. Further follow-up showed increase in stone size with recurrent urinary tract infections, hence shock wave lithotripsy was performed to successfully break and clear the stone fragments. Patient recovered well and was doing fine until last follow-up.

BACKGROUND

The prevalence of urolithiasis in adults is estimated to be 3%–5%.¹ The incidence of paediatric nephrolithiasis is 10% in adults,² with infants constituting 20% of all these cases.³ Urolithiasis in children is associated with an identifiable metabolic abnormality in approximately 40%–50% of cases.⁴ Stone disease in newborns is rarely reported and such cases pose a real challenge in diagnosis as well as management.⁵ We report a rare case of renal stone disease in a newborn aged 3 days.

CASE PRESENTATION

A male newborn aged 3 days presented with decreased urine output for 48 hours with tossing and crying at the time of micturition. The baby was delivered by caesarean section at 38 weeks of gestation (birth weight 2900 g) to a 28-year-old woman (gravida 1, para 1). He cried immediately after birth with APGAR scores of 8 at 1 and 5 min after birth. Maternal antenatal history was uneventful (no diuretic intake) and there was no family history (maternal or paternal) of urolithiasis. The general physical examination immediately after birth was essentially normal. He was started on breast feeding and passed urine and meconium within 8 hours. After 48 hours, parents noted decreased urine output and crying at the time of urination. There were two episodes of fever (100.4°F, no rigour, responding to antipyretics; ie, acetaminophen drops, 10–15 mg/kg/dose) over a period of 24 hours with no history of gross haematuria, pyuria or foul-smelling urine. The neonate had normal limb movements with no palpable suprapubic or renal lump.

INVESTIGATIONS

Results of complete urinalysis, culture sensitivity and complete metabolic evaluation are shown in [table 1](#). Ultrasonography (USG) of kidney, ureter and urinary bladder showed an echogenic focus with acoustic shadow in the lower pole of the left kidney consistent with 7 mm renal calculus with mild hydronephrosis, normal right kidney and bladder ([figure 1](#)). The thyroid function tests were in the normal limit.

TREATMENT

Patient was managed conservatively with intravenous fluids, antibiotics (ceftriaxone injection 75 mg/kg/day in two divided doses for 3 days followed by oral cefixime 8 mg/kg/day in two divided doses) and intake output monitoring as per the paediatrician advice. Patient recovered well and urine output improved within a few days.

OUTCOME AND FOLLOW-UP

Patient was discharged and remained in regular follow-up until the age of 1 year. At 1-year follow-up, USG showed normal size left kidney with stone size increased to 9 mm and mild hydronephrosis. Two episodes of (febrile, between 100°F and 102°F as per parents) urinary tract infection (UTI) occurring during first year of life were managed with culture-specific antibiotics. The urine culture showed the growth of *Escherichia coli* (colony count 10⁴/high power field) in first UTI episode and *Proteus mirabilis* (colony count 10³/HPF) during second UTI episode. Both the episodes were managed with culture-specific antibiotics (oral cefixime, 8 mg/day in two divided doses for 10 days and cefpodoxime 10 mg/kg/day for 10 days in two divided doses). Voiding cystourethrogram (VCUG) was done and it showed normal capacity and contour of bladder with no vesicoureteric reflux (VUR). Keeping in mind the recurrent UTI can be due to renal stone, decision on stone removal was taken. In view of the small size stone, *P. mirabilis* in urine culture and non-visualisation of stone on plain X-ray (which could be due to bowel gas), shock wave lithotripsy (SWL) was planned. After preanaesthetic work-up, patient underwent single session of SWL via Dornier compact alpha (Dornier MedTech, Germany), 2000 shock waves at 20 kV and 60 Hz under general anaesthesia. Post-SWL period was uneventful with plain X-ray and USG of kidney, ureter, urinary bladder region (KUB) in the immediate post-SWL period and after 3 months

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Table 1 Results of metabolic evaluation in this patient.

Parameters	Results	Reference range
BUN	26 mg/dL	8–28 mg/dL
Serum creatine	0.6 mg/dL	0.12–1.06 mg/dL
Serum ionised calcium	4.9 mg/dL	4.8–5.9 mg/dL
Serum phosphorus	3.1 mg/dL	3–6.5 mg/dL
Serum alkaline phosphatase	191 IU/L	<68–217 IU/L
Serum PTH	49.2 ng/mL	10–55 ng/mL
Serum 1,25 (OH) ₂ cholecalciferol Vitamin D3	24.3 nmol/L	>24–86 nmol/mL
24 hours urine calcium	32 mg/24 hours	4 mg/kg/24 hours
24 hours urine oxalate	0.39 mmol/24 hours	<0.46 mmol/24 hours
24 hours urine phosphorus	191 mg/24 hours	<300 mg/24 hours
24 hours urine citrate	159 mg/24 hours	150–191 mg/24 hours
24 hours urine calcium/creatinine	0.3	<0.6
Urine examination		
Urinalysis pH	6.1	
Specific gravity	1.003	
RBC	Full field	
Pus cells	2–3/HPF absent	
Casts or crystals		
Urine culture sensitivity	Sterile	

BUN, blood urea nitrogen; HPF, high power field; PTH, parathyroid hormone; RBC, red blood cells.

showed complete clearance of stone fragments with no evidence of hydronephrosis bilaterally. The stone analysis of stone fragments collected on diapers showed 70% calcium oxalate dehydrate with 30% matrix component. In view of matrix calculi, the patient was kept on a 2-week antibiotic (trimethoprim, 50 mg/100 mL suspension). Parents were thoroughly counselled regarding dietary precautions to prevent recurrent calculi formation. There were no fresh complaints, patient was playful and doing fine until last follow-up, that is, 6 months post SWL.

DISCUSSION

Urolithiasis is a worldwide problem with multifactorial aetiology involving all age groups. Stone disease in children differs from adults with regard to aetiology, presentation, imaging techniques and management.⁶ Approximately 40% of children have family history of kidney stones and associated metabolic abnormalities are present in 30%–84% of cases, which include idiopathic hypercalciuria (most common), hyperuricosuria, hyperoxaluria, hypomagnesuria, hypocitraturia and cystinuria.⁷ Recently, a rise in the incidence of paediatric urolithiasis has been observed probably due to the routine evaluation with USG, changes in socioeconomic status and altered dietary habits.

Figure 1 Ultrasonography showing left mild hydronephrosis (A) with echogenic focus showing acoustic shadow in the lower pole of left kidney (B) consistent with 7 mm renal calculus.

Nephrolithiasis in infants and neonates is exceedingly rare with only few cases reported in the literature. The aetiology may include maternal conditions like hyperparathyroidism, Vitamin D intoxication, diuretic therapy, neonatal diseases like hyperparathyroidism/hypothyroidism, idiopathic hypercalciuria, renal tubular acidosis, inborn errors of metabolism and steroid/diuretic therapy or anatomical causes like ureterovesical reflux (VUR), obstructive uropathy, renal papillary necrosis or neurogenic bladder.⁸ Thus, a thorough antenatal history is essential in such cases, although our case did not reveal any predisposing factor to stone disease and VUR was ruled by normal finding on VCUG.

Nephrocalcinosis is the first and most common differential diagnosis to urolithiasis in newborns. In our case, nephrocalcinosis was ruled out by the lack of echogenicity of medullary region, echogenic focus in upper pole with acoustic shadow and mild right hydronephrosis. On subsequent follow-up, the infant was not found to have any crystals on urine examination. Although no specific genetic analysis test was done to rule out primary hyperoxaluria or xanthinuria, these hereditary causes can be ruled out by lack of positive family history of stones, solitary calculus in single kidney, absence of associated nephrocalcinosis and lack of associated symptoms such as polyuria, acidosis, growth retardation and renal failure.

The renal stones have been rarely reported in infants less than 3 months. A few case reports of antenatal diagnosis of renal stones in fetus are available, which were managed conservatively in the postnatal period.^{9,10} Chandra and Verna¹¹ reported a case of idiopathic renal calculus in a male infant aged 2 days. The patient presented with gross haematuria (in contrast to our case) on day 2 and USG revealed 3–4 mm calculus in upper pole of right kidney with no evidence of hydronephrosis. The metabolic evaluation was normal with urine calcium/creatinine ratio of 0.2. Urine culture was sterile and patient was managed conservatively over an 18-month follow-up period. Stoll and Listman¹² reported a female baby aged 3 days presenting with seizures and found to have renal stones secondary to hypomagnesemia, hypercalciuria and hypocitraturia. These metabolic abnormalities were

corrected and patient passed the stones after 2 months without any intervention.

Literature reported symptoms related to UTI as the most common symptom and *P. mirabilis* as the most commonly reported organism on urine culture in infants presenting with renal calculi.¹³ In our case, low urine output was the primary presentation that ultimately led to the final diagnosis.

There is a controversy regarding the ideal management of renal calculi in newborns. Conservative approach is suggested in less than 5 mm calculi and surgical intervention is advised in urine flow obstruction or failed conservative therapy.¹⁴ The role and efficacy of SWL in infants has been reported in literature by Shukla *et al.*¹⁵ SWL is the preferred management option in infants except in cysteine and uric acid calculi, nephrocalcinosis, malrotated kidney and associated bladder calculi.⁵ We managed this patient with SWL and the stone was successfully fragmented and the young kid recovered well. Even after extensive search of literature, we could not find any case report of renal stone in a newborn baby presenting with normal metabolic parameters (including urine calcium) and negative family history of risk factors for renal stone disease. To the best of knowledge of the authors, this could be the first case report of renal calculus in an infant aged 3 days, who was aggressively followed up and successfully managed with SWL. Despite extensive work-up of the patient, no identifiable aetiology of renal stone could be found and hence these could be labelled as idiopathic nephrolithiasis. Thus, this case report adds an important piece of

literature to the existing literature on renal calculi in infants which are rarely encountered and reported and help in understanding the pathophysiology of renal stone disease in newborns and help develop a consensus on the ideal management protocol in such rare scenarios.

Contributors All the authors have contributed equally to this manuscript.

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Learning points

- The renal calculi in newborns should be thoroughly investigated to find out the possible aetiology.
- Complete metabolic evaluation of such neonate is advised.
- Patients should be followed over a time to detect the possible sequelae and possible management of stone in the near future.
- Stone analysis post stone management must be an integral part of patient management as it can help plan future recurrence of prevention strategies.

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