Pediatric Urolithiasis Presenting as Acute Urinary Retention: A Case report and Review

Stacia Novia Marta[*,1], **Nyoman Dwi Aussie Hary Mastika**[*], **Ni Nyoman Sri Rahayu Wulandari**[*] **and Kadek Budi Santosa**[**]
[*]Department of Surgery, Bhakti Rahayu Hospital, Bali, Indonesia., [**]Division of Urology, Department of Surgery, Faculty of Medicine, Universitas Udayana/Sanglah Hospital, Bali Indonesia.

ABSTRACT Urolithiasis in infants are relatively rare, and because of its nature in presenting with Non-specific symptoms the diagnosis of infantile urolithiasis may be rather challenging leading to delayed treatment thus may cause renal damage and subsequent failure by stone obstruction. The evaluation includes complete medical history and physical examination complemented by appropriate laboratory and imaging studies. We present a case report of a 9 month infant with bilateral nephrolithiasis presenting with acute urinary obstruction caused by impacted anterior urethral stone.

KEYWORDS Pediatric urolithiasis, nephrocalcinosis, Pediatric Urinary Retention

Introduction

Urolithiasis is less common in the pediatric age group where the incidence is almost 10% of that in adults. Urolithiasis in infants represents 20% of the frequency of urolithiasis retrieved in the whole pediatric age group[1] and microcalculi or Nephrocalcinosis might be the first step in stone formationp[2]. The predisposing factor is multifactorial, including genetic inheritance, nutrition, metabolic and anatomical abnormalities, urinary tract infection, environmental factors, and stone-inducing drugs, but it is more often associated with metabolic abnormalities including hypercalciuria, hypocitraturia, hyperoxaluria, hyperuricosuria, and cystinuria. Children are not able to express complaints such as flank pain, and typical clinical features are urinary retention, irritability, and signs of infection. Although challenging, the diagnosis and decision making on treatments should be based on thorough evaluation of the underlying risk factors, therefore avoiding recurrence.[3]

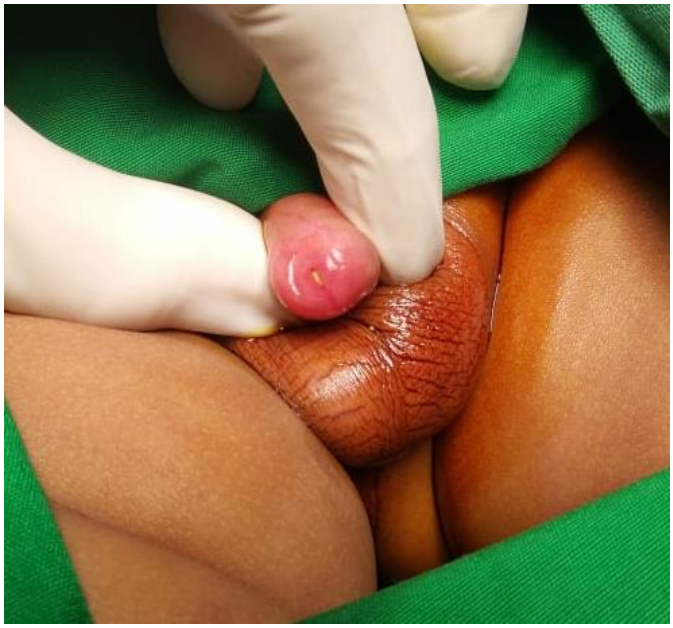

Figure 1: Hard mass at the proximal part of the anterior urethra and the penis presented edema and hyperemia.

DOI:10.5455/IJMRCR.Pediatric-Urolithiasis
First Received: August 23, 2019
Accepted: September 13, 2019
Associate Editor: Ivan Inkov (BG)

[1]Department of Surgery, Bhakti Rahayu Hospital, Bali, Indonesia. Email: stacianoviamarta@gmail.com

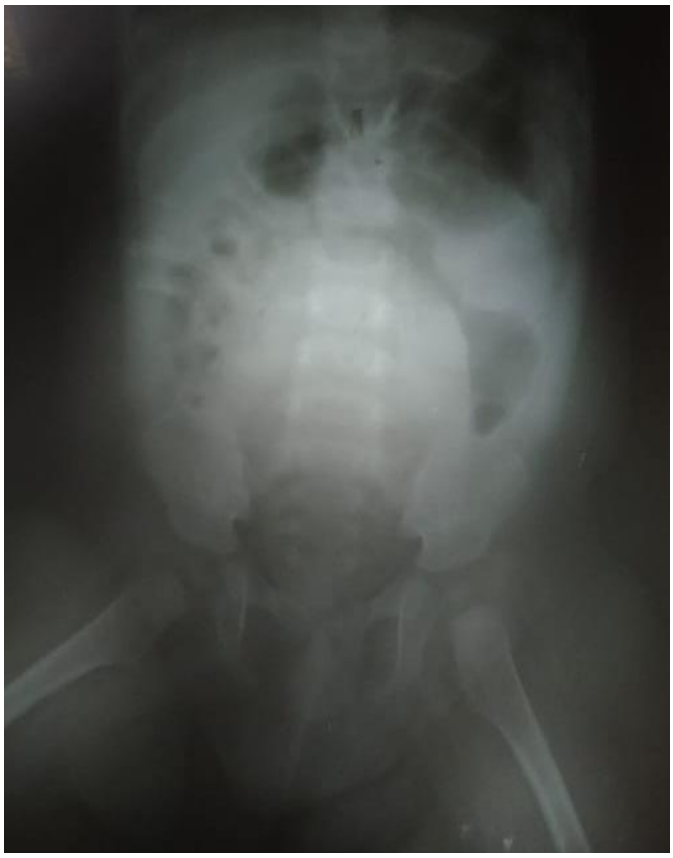

Figure 2: No calcification from plain abdominal radiography.

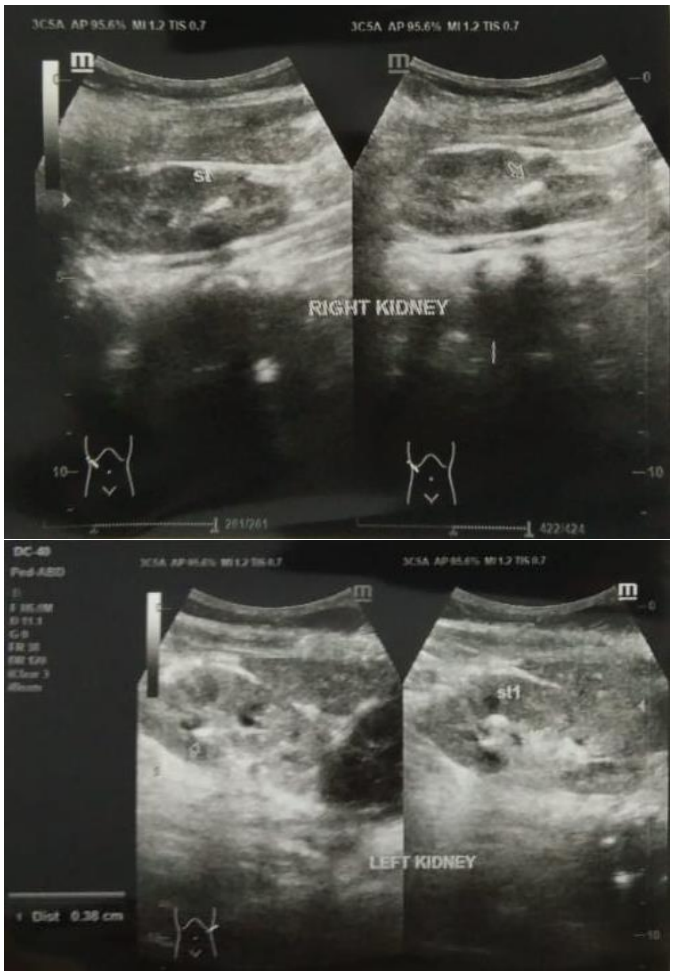

Figure 3: Abdominal ultrasonography revealed bilateral nephrolithiasis.

Case report

A 9 months old male baby was referred to the surgery department with the primary complaint of urinary retention. The symptoms started three days before admission described as decreased volume of urine, abdominal distention, and irritability. The patient was delivered at term by non-complicated vaginal delivery weighing 3300 grams, height 3,6 cm. The mother was diagnosed with hyperthyroid through pregnancy and was treated with Propylthiouracil (PTU). There was no family history of urolithiasis. Physical examination confirmed a well-nourished baby (body weight 8800 gr, height 71cm) with normal vital sign. An enlarged bladder was palpated as well as a hard mass at the proximal part of the anterior urethra. The penis presented with hyperemia, oedema, and stenotic meatus (Figure 1). Urinalysis confirmed leukocytosis. There were no calcifications on plain abdominal radiography (Figure 2), abdominal ultrasonography revealed bilateral nephrolithiasis 5 mm in diameter on the mid pole of the right kidney, and on the lower pole of the left kidney there were multiple stones with diameters of 3,8 mm and 6,6 mm, without hydronephrosis on both sides (Figure 3). The patient underwent dorsal meatotomy. Single stone with a diameter of 5 mm was evacuated from the anterior urethra (Figure 4). Chemical analysis of the stone showed positive minerals such as calcium, uric acid, and ammonium. The rest of the kidney stones were treated conservatively with hydration and adequate fluid intake and is still being observed. The metabolic evaluation was performed for further examination, and the result was normal.

Discussion

Urolithiasis of infants is found predominantly in male children.1 Positive family history is considered to be an essential factor in the diagnosis of urolithiasis[4], while metabolic imbalances are the most common risk factors for the development of urolithiasis in the first year of life.[5] The significant metabolic abnormalities include: hypercalciuria, hypocitraturia, hyperoxaluria, hyperuricosuria, and cystinuria[6,7] the formation of neonatal kidney stones may be a result of diseases such as maternal hyperparathyroidism, vitamin D intoxication and therapies such as diuretics while neonatal disease such as hyperparathyroidism, hypothyroidism, idiopathic hypercalciuria, renal tubular acidosis, inborn errors of metabolism and steroid or diuretic therapy may also have a significant role.[8] In this case, there was no family history of urolithiasis, but positive consumption of antithyroid medication was revealed to treat maternal hyperthyroid. Hyperthyroid may have a contributing factor in the development of renal stone. It increases the bone turn over, thus may cause hypercalcemia which can lead to hypercalciuria.

Distal Renal Tubular Acidosis (DRTA) which may be a manifestation of hyperthyroid due to metabolic disturbances or as an inherited autosomal recessive pathology may have an essential role in stone development. In Chronic DRTA, there is an increase in citrate reabsorption at the proximal tubules leading to hypocitraturia. Citrate is known as an inhibitor of stone formation by

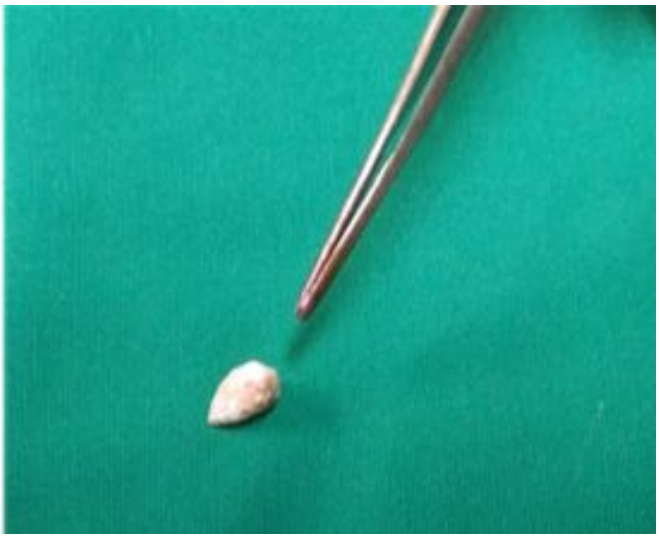

Figure 4: Single stone evacuated from the anterior urethra.

directly inhibiting spontaneous nucleation of calcium oxalate. This condition may be inherited leading to autosomal recessive distal RTA. The parathyroid hormone has a leading role in the regulation of calcium and phosphor in the extracellular fluid. An overactive parathyroid gland may lead to the formation of kidney stones in about one percent of patients with Ca-stones. The stones revealed are either Ca-oxalate or Ca-phosphates. Hyperparathyroid at some extent may lead to hypercalcemia thus hypercalcuria. This condition may also increase phosphate excretion in the urine.[9] Despite the fact described above, hypothyroid will lead to the decreased glomerular filtration rate which may cause decreased urine output and renal water excretion.

Maternal hyperthyroid may affect newborn thyroid hormone metabolism and may induce neonatal hypothyroid. Two similar drugs namely Methimazole (MMI) and PTU may cross the placenta thus may aid in the development of fetal and neonatal hypothyroidism.[10] The hypothyroid condition may have a significant role in the development of nephrolithiasis. The postulated mechanism of hyper and hypothyroidism in stone formation is said to be that the intact mitochondria can accumulate calcium against the concentration gradient as an active process, in the proximal or distal renal tubular cell. In hypothyroidism, this will lead to high intracytoplasmic calcium concentrations predisposing to nephrocalcinosis which is a predisposing factor for the development of nephrolithiasis.[6,10]

The presenting signs and symptom of pediatric stone are different from those in adults. Flank pain with or without hematuria being the main complaint in adults are difficult to evaluate in children, especially in infants. According to several works of literature, presenting symptoms of infantile urolithiasis are dysuria presenting with irritability, abdominal colic, passing of stones, macroscopic and microscopic hematuria, penile oedema, enuresis, vomiting and anorexia.[11]

The anterior urethra is the most frequent site of obstruction.[12] As in this case, the patient presented with acute urinary retention and a palpated stone in the anterior urethra. In the presence of urethral calculi, plain abdominal radiography and ultrasonography may identify the stones and asses the impact of obstruction on the upper urinary tract.[13] Abdominal radiography may not reveal calcifications, but on the other hand abdominal ultrasonography may well define bilateral nephrolithiasis without hydronephrosis on both sides. The most common location of stone presentation is the lower pole.[4] As seen in this case, one side of the kidney had stones in the lower pole.[14]

There are two types of urethral calculi/stones namely primary (when formed within the urethra due to some anatomical defect) or secondary when stones from the upper urinary tract or bladder get lodged into the urethra.[12] According to the above findings of the patient and supported by literature, this may explain that the urethral stone of this patient originates mainly from the kidney.

Leucocytes, nitrite, and leucocytes esterase may detect the presence of infection in the urine.[15] It is well understood that Urinary tract infection may cause urolithiasis. On the other hand stone formation may itself predispose urinary tract infection.[16] Urinalysis from the patient revealed urine infection. Obstructed stone in the urethra may lead to urine stasis contributing to progression of urine infection.

Stone analysis of this patient was performed and revealed positive calcium, uric acid, and ammonium. While there seems to be an increased incidence of pediatric urolithiasis, urethral stone accounts for 0.3% of all urolithiasis in the pediatric age group. These stones are mainly constituted of urates and or triple (Ammonium, Magnesium, and Calcium) phosphates [13] which is similar to our case.

Stones have the varying composition of salts, where the most common found in children are calcium oxalate, followed by calcium phosphate.[17] Calcium oxalate stones are commonly reported as the most common type of stones.[12,7] To ascertain factors that predispose stone formation thus metabolic and electrolyte assessment should be considered.[6] Although we found calcium and uric acid in the stone, the metabolic evaluation revealed no primary metabolic abnormality present in this case.

The management of renal stones in infants is not well defined, but it is essential to determine the specific cause and fundamental pathology.[1] Kidney stones of less than 0.7cm and 0.5cm may pass on its own in 24-50% and >60% of cases respectively, therefor by determining the stone size this should enable the surgeon to manage by careful waiting in most cases should there be no complication nor emergencies such as urinary retention in order to prevent renal failure.[8,18] In cases where stone measurements are more than 0.7cm,a positive metabolic abnormalities such as hyperuricosuria, stone formation containing struvite and cystine, and accompanying urinary tract abnormalities such as uteropelvic junction (UPJ) obstruction or ureterovesical junction (UVJ) obstruction, this will further need the combination of sonography evaluation, medical treatment, or surgical intervention to prevent recurrence and further complication.[4,19] The fact that the was a passage of a stone found in the urethra, no renal anomaly by abdominal sonography, and no cysteine or sturvit observed in the stone composition, after an open surgery by dorsal meatotomy was performed, we preferred conservative management for the remaining kidney stones by watchful observation.

Conclusion

Infantile urolithiasis is a rare condition especially in well-developed countries, but the probability of urolithiasis should be kept in mind, and these children should undergo renal ultrasonography examination so early diagnosis and prompt treatment can be made to prevent further complication. Recent studies reveal several risk factors for the development of infantile urolithiasis including metabolic factor as the most common

cause. Although recurrence is lower than in adults, prompt evaluation and control of the risk factors are needed to prevent further complications and maintain quality of both kidneys.

Competing Interests

There were no financial supports or relationships between authors and any organization or professional bodes that could pose any conflict of interest.

Funding

None.

References

1. Zalula CM, Bilali G, Kumba AM, Mukuku O. Urinary lithiasis in the pediatric age group: Case report and literature review. 2017;3(1):11–3.

2. Narter F, Narter F, Sarıca K. Urinary Stones in Neonates: Dilemma Between Urolithiasis and Nephrocalcinosis Yeni Doğanlarda Üriner Sistem Taşları: Ürolitiyazis ve Nefrokalsinozis İkilemi. 2015;1–6.

3. Mantan M, Bagga A. Etiology of nephrocalcinosis in northern Indian children. 2007;829–33.

4. Sheth KR, White JT, Perez-orozco AF, Debolske ND, Hyde CR, Geistkemper C, et al. Evaluating Natural History and Follow Up Strategies for Non-obstructive Urolithiasis in Pediatric Population. 2018;6(November):10–5.

5. Coward RJM, Peters CJ, Duffy PG, Corry D, Kellett MJ, Choong S, et al. Epidemiology of paediatric renal stone disease in the UK. 2003;

6. Alemzadeh-ansari MH, Valavi E, Ahmadzadeh A. Predisposing Factors for Infantile Urinary Calculus in South- West of Iran. 2014;8(1):53–7.

7. Keijzer-veen MG, Kleinveld HA, Lequin MH, Dekker FW, Nauta J, Rijke YB De, et al. Original Investigations. Pathogenesis and Treatment of Kidney Disease Renal Function and Size at Young Adult Age After Intrauterine Growth Restriction and Very Premature Birth. 2007;50(4):542–51.

8. Copelovitch L. Urolithiasis in Children Medical Approach. 2012;59:881–96.

9. Al-jebouri MM, Atalah N. A Study on the Interrelationship between Renal Calculi , Hormonal Abnormalities and Urinary Tract Infections in Iraqi Patients. 2012;2012(February):6–10.

10. Russo EGL, Chiovato FOL, Benvenga MGS. Pregnancy outcome in women treated with methimazole or propylthiouracil during pregnancy. 2015;

11. Ba F, Sebahat G, Poyrazo H, Dü R. Urolithiasis in infants: evaluation of risk factors. 2012;

12. Akhtar J, Ahmed S, Zamir N. Management of Impacted Urethral Stones in Children. 2012;22(8):510–3.

13. Mbouché LO, Andzé GO, Makon ASN, Bob DN, Tamufor EN, Amenglé AL, et al. Case Report Acute Urinary Retention in the Male Child from Urethral Calculi: A Report of Three Cases. 2019;2019(Figure 2).

14. Rahman F, Akter Luna S, Jesmin T, Roy RR. Nephrocalcinosis in children: A review. Paediatr Neph J. 2018;3(1):38–47.

15. Kokorowski P, Katherine H, Caleb N. Evaluation of pediatric nephrolithiasis. Indian J Urol. 2010;26(4):531–5.

16. Güven AG, Koyun M. Urolithiasis in the first year of life. 2010;129–34.

17. Do DJS, Msph TCH, Sc D, Shatat IF, Orak JK. Increasing Incidence of Kidney Stones in Children Evaluated in the Emergency Department. J Pediatr [Internet]. 2010;157(1):132–7. Available from: http://dx.doi.org/10.1016/j.jpeds.2010.02.004

18. Trends C, Factors R. Current Trends, Evaluation, and Management of Pediatric Nephrolithiasis. 2015;

19. Telli O, Hamidi N, Bagci U, Demirbas A. What happens to asymptomatic lower pole kidney stones smaller than 10 mm in children during watchful waiting? 2017;853–7.