BJMS
Borneo Journal of Medical Sciences

CASE REPORT

Rare Calyceal Diverticulum in a 10-year-old Child: A Case Report

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Received: 11 October 2024

Accepted: 7 January 2024

Published: 2 September 2025

DOI: https://doi.org/10.51200/bjms.v19i3.5482

Keywords: *Calyceal diverticulum, Urinary tract infection, CT abdomen*

ABSTRACT

A calyceal diverticulum is an outpouching of the collecting system into the renal parenchyma. A 10-year-old obese child was presented with on and off fever associated with polyuria for 2 months. Initial ultrasound showed complex cysts at the upper pole of right kidney. Computed tomography (CT) abdomen in excretory phase revealed passive filling of the "cysts". The patient was treated conservatively with antibiotics and was discharged. Calyceal diverticulum is rare, happening in only 0.21 to 0.6% of intravenous urograms of both adults and children. Underlying chronic phimosis and recurrent urinary tract infection could have contributed to the formation of calyceal diverticulum. Calyceal diverticulum should be considered as a possible diagnosis in children when the patient is presented with urinary tract symptoms and multiple cysts are found on ultrasound. CT abdomen in excretory phase is required to diagnose this condition although it gives higher radiation dose to the child.

INTRODUCTION

A calyceal diverticulum is the outpouching of the upper collecting system into renal parenchyma rather than confined within the renal pelvis. It connects with the main collecting system through a narrow channel and is covered with transitional cell epithelium (Waingankar et al., 2014). It may be difficult to differentiate calyceal diverticulum from renal pelvis, simple renal cysts, parapelvic cysts, hydrocalyx, cystic renal tumours, early presentation of autosomal dominant

polycystic kidney diseases or other renal cystic diseases (Alaygut et al., 2020; Bombinski et al., 2015; Zhao et al., 2022). Calyceal diverticulum is rare, happening in only 0.21 to 0.6% of intravenous urograms of both adults and children. In 48.9% of the cases, it occurs in both upper poles of the kidneys, and in 29.7% and 21.4%, it happens in lower poles of the kidneys (Waingankar et al., 2014). Calyceal diverticulum affects women more commonly than men with incidence of 63% and 37% respectively. Sizes of diverticulum ranges from 0.5 to 7.5cm, with average size of 1.72cm. Stones are found in 9.5% to 50% of the cases with sizes ranging from 0.1cm to 3.0cm, averaging at 1.2cm (Waingankar et al., 2014). Several factors have been proposed as the causes of calyceal diverticulum, such as congenital causes, obstruction, infection, neuromuscular (dysfunction of sphincter around the calyces), traumatic, and fibrotic causes (Waingankar et al., 2014). Calyceal diverticulum can be classified into two types namely Type I (communicating with an infundibulum or minor calyx) and Type II (communicating with a major calyx or renal pelvis) (Waingankar et al., 2014).

There are no history, physical examination, or laboratory findings that are diagnostic of calyceal diverticula. Some of the symptoms presented maybe flank pain, symptoms of urinary tract infection, or haematuria (Waingankar et al., 2014). Asymptomatic patients usually do not require any treatment. However, several cases suggested that the diverticulum may close off and become a cyst, abscess, or may cause symptomatic enlargement, stones, and urinary tract infections (Estrada et al., 2009; Nicholas, 1975; Siegel & McAlister, 1979; Zhang et al., 2019). If complications of the calyceal diverticulum arises, either open excision or minimally invasive methods such as ureterorenoscopy, percutaneous puncture, laparoscopy can also be performed during surgical intervention (Alaygut et al., 2020; Chattopadhyay et al., 2021). In this case report, we presented a case of a 10-year-old boy with urinary urgency. Calyceal diverticulum was diagnosed upon computer tomography (CT) abdomen scan in excretory phase. The patient was treated conservatively with antibiotics and was well upon discharge and one year follow-up.

CASE PRESENTATION

We presented a case of 10-year-old boy who had underlying obesity weighing 57.9 kg. He presented with an increase in frequency of urination for 2 months and worsening for 2 weeks. He also had fever for 2 weeks with on and off chills. Otherwise, there was no dribbling or straining during urination, no dysuria, haematuria, abdominal pain or loin tenderness. Initial blood investigation noted white cell count at 29.7 x 103/uL. Meanwhile,

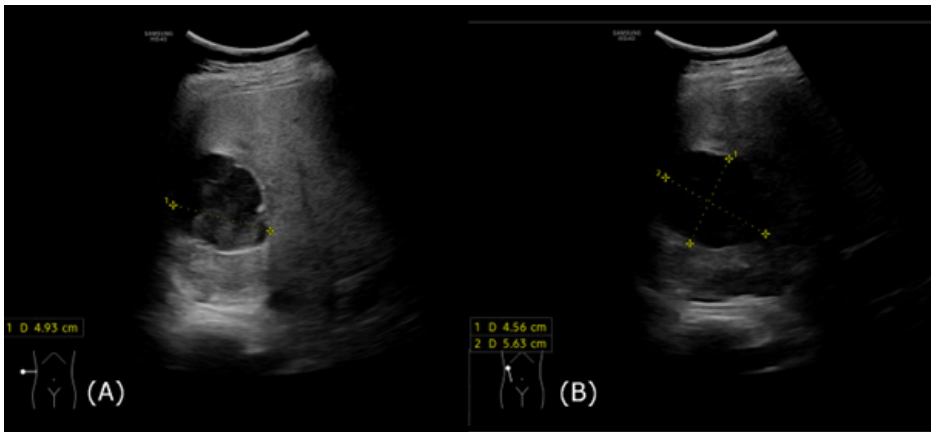
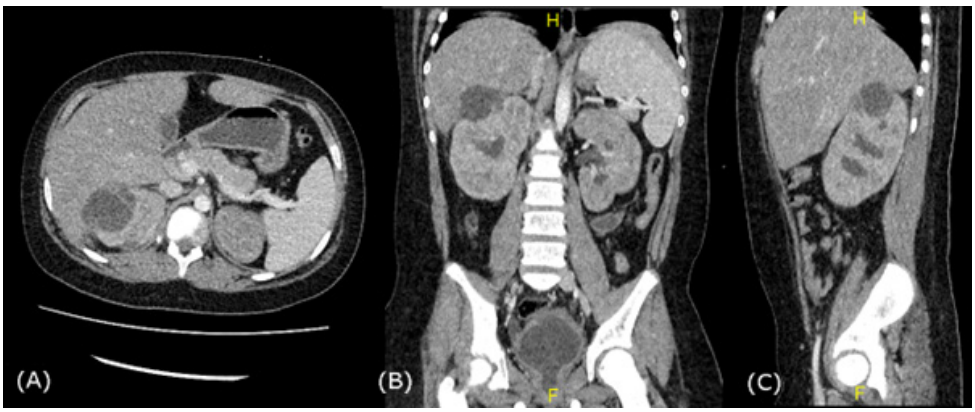
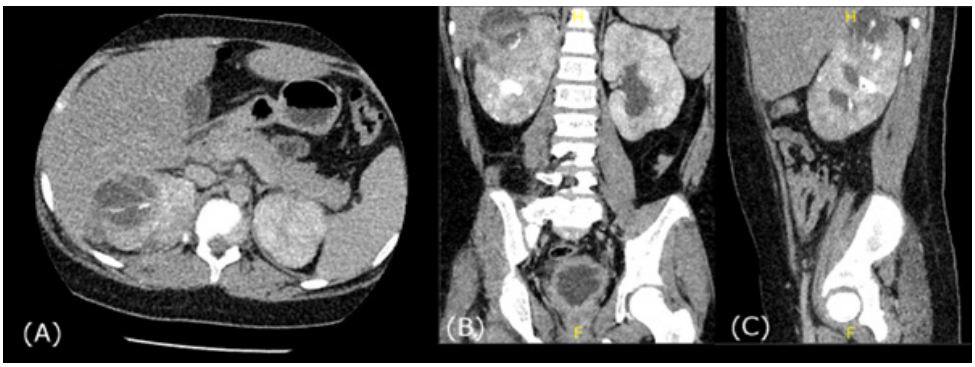


Figure 1A and 1B: show a well-defined, anechoic, lobulated right upper pole calyceal diverticulum as seen on ultrasound.



Figures 2A, 2B, and 2C : Show the well-defined, round, lobulated, hypodense right upper pole calyceal diverticulum with septation within on



Figures 3A, 3B, and 3C : Show the passive filling of the calyceal diverticulum during excretory phase on CT abdomen. portal venous phase of

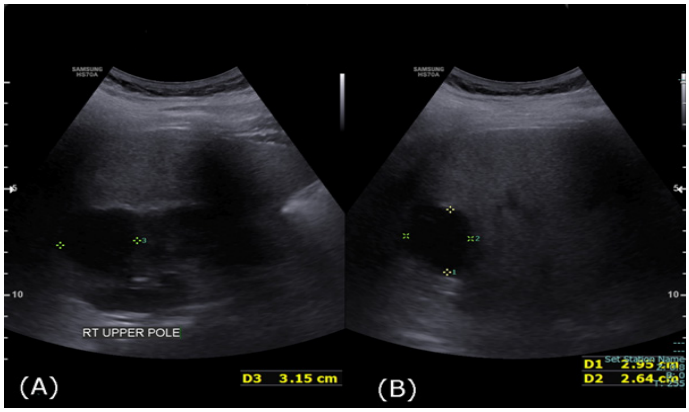


Figure 4A and 4B : Show a repeat ultrasound at day-14 after admission revealing a right upper pole cystic lesion had become smaller in size. CT

urea was at 26.5 mmol/L and creatinine level at 313 umol/L. The patient had acute kidney failure.

Ultrasound kidney, ureter, bladder (KUB) (Figure 1) was done on day 1 of admission. It showed a multiseptated cystic lesion with debris within the upper pole of right kidney with bilateral mild hydronephrosis. There was loss of corticomedullary differentiation of the bilateral kidneys which could be suggestive of infective or pyelonephritic changes. In view of the complex renal cystic lesion, the patient proceeded with contrasted CT abdomen (Figure 2) on day 3 of admission. A well-defined lobulated cystic lesion (HU range from

+1 to +20) was noted at the upper pole of right kidney, measured 4.5x4.7x6.7 cm (APxWxCC) with few internal septa but no calcification. The patient proceeded with excretory phase in view of complex nature of the cyst. In the excretory phase at 8 minutes (Figure 3), passive filling and layering of contrast within the cyst was noted. There was also a small tract with length of 8mm that communicates the cyst with the upper pole calyx. Both the kidneys appear swollen with poor nephrogram and bilateral moderate hydronephrosis and hydroureters. The diagnosis was changed to right upper calyceal diverticulum secondary to sequala from recurrent infection in view of the CT abdomen findings as described above.

Ultrasound was repeated at 14 days after admission (Figure 4). The right upper pole cystic lesion had become smaller in size, measuring 3.0x2.6x3.2 cm (APxWxCC). However, another new exophytic hypoechoic lesion appeared at the right upper pole, measuring 1.4x2.0x2.2 cm (APxWxCC). Irregular renal margins may represent scarring due to residual infective changes. There was also irregular thickening of the urinary bladder wall, in keeping with cystitis.

Initial venous blood gas noted compensated metabolic acidosis (pH at 7.35, bicarbonate at 13.9 mmol/L and base excess at -11.3 mmol/L). At day 4 of admission, there was difficult urinary catheter insertion because the child had a buried penis with phimosis. Pus was noted to come out from meatus. The urinary catheter was eventually inserted, releasing the phimosis. Penile swab culture and sensitivity (C&S) and urine C&S repeated showed the growth of E. coli which was sensitive to meropenem and intermediate sensitivity to amoxicillin/clavulanic acid. The patient undergone conservative antibiotics treatment and completed a total of 9 days of antibiotics. Upon discharge, his serum urea level was improved to 5.0 mmol/L and creatinine level improved to 66 umol/L. The white cell count was improved to 13.87x 103/uL upon discharge. Phimosis was noted when it was decided patient will be readmitted later for circumcision. Further investigations such as micturating cystourethrogram (MCUG) were not conducted unless patient has recurrent symptoms because phimosis is a known cause of vesicoureteral reflux which would lead to recurrent urinary tract infections (UTI).

The patient was later electively readmitted for circumcision for phimosis and repair of buried penis. During the operation buried penis and glandular hypospadias was noted. The patient was well during 3 months follow-up.

DISCUSSION

On ultrasound, calyceal diverticulum appears as anechoic cysts unless filled with hyperechoic stones. The stones will change position according to the body habitus of the patient (Waingankar et al., 2014). Heterogeneously echogenic sediments forming a fluid level is indicative of infection. However, this feature is not helpful in differentiating calyceal diverticulum from renal cyst (Bombinski et al., 2015). Calyceal diverticulum may also be suspected if a connection is demonstrated between renal cyst with the collecting system on ultrasound but this feature may not be always demonstrable (Alaygut et al., 2020). On CT scans, calyceal diverticulum can be seen during excretory phase of the CT abdomen when there is passive filling of the diverticulum from the renal pelvis (Waingankar et al., 2014). CT abdomen in excretory phase is necessary to diagnose calyceal diverticulum despite increased radiation dose to a child. This is because slight increase in density within the diverticular content during the renal parenchymal phase is not specific and may be mistaken as renal tumour enhancement (Bombinski et al., 2015).

A study conducted by Alaygut D et al. in 2020 found that 9 out of 40 children follow-up for renal cysts or parapelvic cysts have calyceal diverticulum. These children were

aged from 1 to 17 years old. Two children had renal stones while three children had recurrent urinary tract symptoms (Alaygut et al., 2020). Ningshu Lin et al., in a study conducted in 2013 on adolescents and adults, showed that by applying compression bands on the abdomen [similar to intravenous urogram (IVU)] and excretory image acquisition of computed tomography urography (CTU) at 60 minutes after contrast administration may increase sensitivity and specificity in identifying calyceal diverticulum (Lin et al., 2013). However, such a measure is impractical to perform in a busy hospital setting.

In our case, the calyceal diverticulum was round, located at the upper pole of right kidney measuring 4.5cm in size, and showed incomplete filling during excretory phase of CT renal at 8 minutes. Underlying chronic phimosis and recurrent urinary tract infection could contribute to the formation of calyceal diverticulum in this child.

CONCLUSION

Calyceal diverticulum should be considered as a possible diagnosis in children with urinary tract infection and multiple cysts found on ultrasound. Recurrent urinary tract infections could have contributed to the formation calyceal diverticulum in children. The condition can be diagnosed by excretory phase in CT abdomen although it gives higher radiation dose in children.

CONFLICT INTEREST

No funding was received for the preparation of this article. No financial competing interests declared.

CONSENTS

Written consent was taken from the mother to publish this case report. A copy of the written consent is available for review by Chief Editor.

ACKNOWLEDGEMENTS

None

REFERENCES

Alaygut, D., Sahin, H., Camlar, S. A., Soyaltin, E., Oncel, E. P., Alparslan, C., Mutlubas, F., Yavascan, O., & Demir, B. K. (2020). Calyceal diverticulum of the kidney in pediatric patients - Is it as rare as you might think? J Pediatr Urol, 16(4), 487 e481-487 e486. https://doi.org/10.1016/j.jpurol.2020.05.151

Bombinski, P., Warchol, S., Brzewski, M., Biejat, A., Dudek-Warchol, T., Krzemien, G., Szmigielska, A., & Toth, K. (2015). Calyceal diverticulum of the kidney - diagnostic imaging dilemma in pediatric patients - case report. Pol J Radiol, 80, 27-30. https://doi.org/10.12659/PJR.892053

Chattopadhyay, A., Biswas, S. K., & Halder, P. (2021). Giant Calyceal Diverticulum in a Child with Solitary Kidney: A Rare Experience. J Indian Assoc Pediatr Surg, 26(6), 451-453. https://doi.org/10.4103/jiaps.JIAPS_231_20

Estrada, C. R., Datta, S., Schneck, F. X., Bauer, S. B., Peters, C. A., & Retik, A. B. (2009). Caliceal diverticula in children: natural history and management. J Urol, 181(3), 1306-1311; discussion 1311. https://doi.org/10.1016/j.juro.2008.10.043

Lin, N., Xie, L., Zhang, P., Min, Y., Yang, Y., Wang, Y., & Xia, M. (2013). Computed tomography urography for diagnosis of calyceal diverticulum complicated by urolithiasis: the accuracy and the effect of abdominal compression and prolongation of acquisition delay. Urology, 82(4), 786-790. https://doi.org/10.1016/j.urology.2013.06.005

Nicholas, J. L. (1975). An unusual complication of calyceal diverticulum. Br J Urol, 47(4), 370. https://doi.org/10.1111/j.1464-410x.1975.tb03987.x

Siegel, M. J., & McAlister, W. H. (1979). Calyceal diverticula in children: unusual features and complications. Radiology, 131(1), 79-82. https://doi.org/10.1148/131.1.79

Waingankar, N., Hayek, S., Smith, A. D., & Okeke, Z. (2014). Calyceal diverticula: a comprehensive review. Rev Urol, 16(1), 29-43. https://www.ncbi.nlm.nih.gov/pubmed/24791153

Zhang, Z., Zhang, Y., Wang, X., Chen, D., Peng, N., Chen, J., Bleyer, A., Wang, Q., Liu, Y., & Zhang, Y. (2019). Challenges in the diagnosis of calyceal diverticulum: A report of two cases

and review of the literature. J Xray Sci Technol, 27(6), 1155-1167. https://doi.org/10.3233/XST-190549

Zhao, Y., Zhang, R., Yun, Y., Wu, X., Li, H., Wang, J., Wang, W., Jia, C., & Song, H. (2022). A case report of renal calyceal diverticulum with hypertension in children and review of literature. BMC Pediatr, 22(1), 35. https://doi.org/10.1186/s12887-021-03081-5