frontiers | Frontiers in Pediatrics

TYPE Case Report
PUBLISHED 03 April 2025
DOI 10.3389/fped.2025.1539220

OPEN ACCESS

EDITED BY
Mengsi Hu,
Shandong Provincial Hospital, China

REVIEWED BY
Xiaojuan Wu,
Huazhong University of Science and Technology, China
Guoqiang Du,
Shandong Provincial Hospital affiliated to Shandong First Medical University, China

*CORRESPONDENCE
Şule Çalışkan Kamış
✉ sulecaliskan87@yahoo.com

RECEIVED 18 December 2024
ACCEPTED 20 March 2025
PUBLISHED 03 April 2025

CITATION
Kamış ŞÇ, Yağcı B, Koç AS and Taş ZA (2025) Metanephric adenoma in a pediatric patient case report.
Front. Pediatr. 13:1539220.
doi: 10.3389/fped.2025.1539220

Metanephric adenoma in a pediatric patient case report

Şule Çalışkan Kamış[1]*, Begül Yağcı[1], Ayşe Selcan Koç[2] and Zeynel Abidin Taş[3]

[1]Department of Pediatric Hematology and Oncology, University of Health Sciences, Adana Faculty of Medicine, Adana City Education and Research Hospital, Adana, Türkiye, [2]Department of Radiology, University of Health Sciences, Adana Faculty of Medicine, Adana City Education and Research Hospital, Adana, Türkiye, [3]Department of Medical Pathology, University of Health Sciences, Adana Faculty of Medicine, Adana City Education and Research Hospital, Adana, Türkiye

Metanephric adenoma (MA) is a rare benign renal tumor, with an incidence of 0.2%–1%. Approximately 90% of MA cases present with the BRAF V600E mutation. This study reports an 8-year-old male child who presented with abdominal pain for one month. Abdominal ultrasound revealed a cystic necrotic mass measuring 56 × 45 mm in the right kidney. A preliminary diagnosis of Wilms tumor (WT) led to the initiation of preoperative vincristine therapy. Right nephroureterectomy was performed by pediatric surgery. Histopathological analysis could not differentiate between MA and WT. Immunohistochemical findings were positive for WT1, PANCK (weak focal), INI1 (intact), PAX8, CD56, and CD57. Genetic testing confirmed the presence of the BRAF V600E mutation (1799T > A, 1799_1800TG > AA). The patient was diagnosed with MA and was followed without chemotherapy. In conclusion, MA, which can be mistaken for WT, should be considered in the differential diagnosis of pediatric renal neoplasms. Immunohistochemical evaluation and genetic testing are essential for a definitive diagnosis.

KEYWORDS

metanephric adenoma, Wilms tumor, BRAF v600E mutation, case report metanephric adenoma, BRAF v600E mutation 38

Introduction

Metanephric adenoma (MA) is a rare benign renal tumor, often misdiagnosed as Wilms tumor (WT), particularly in pediatric cases. Despite being exceedingly rare in children, there is a limited number of case reports in the literature (1, 2). The incidence of MA accounts for approximately 0.2%–1% of all renal tumors (3). While MA is predominantly observed in adults, several pediatric cases have also been documented (4). In most instances, the tumor is asymptomatic and is typically discovered incidentally during radiological imaging (5). Epidemiological studies indicate that MA occurs more frequently in females than males (6). Around 90% of MA cases have been linked to the BRAF V600E mutation, providing further insight into the molecular mechanisms underlying the tumor (7). The treatment of choice for MA is nephron-sparing surgery, which aims to preserve renal function and minimize the loss of healthy kidney tissue (8).

Case report

An 8-year-old boy presented with a 1-month history of abdominal pain. Tenderness was detected in the abdomen during physical examination. His

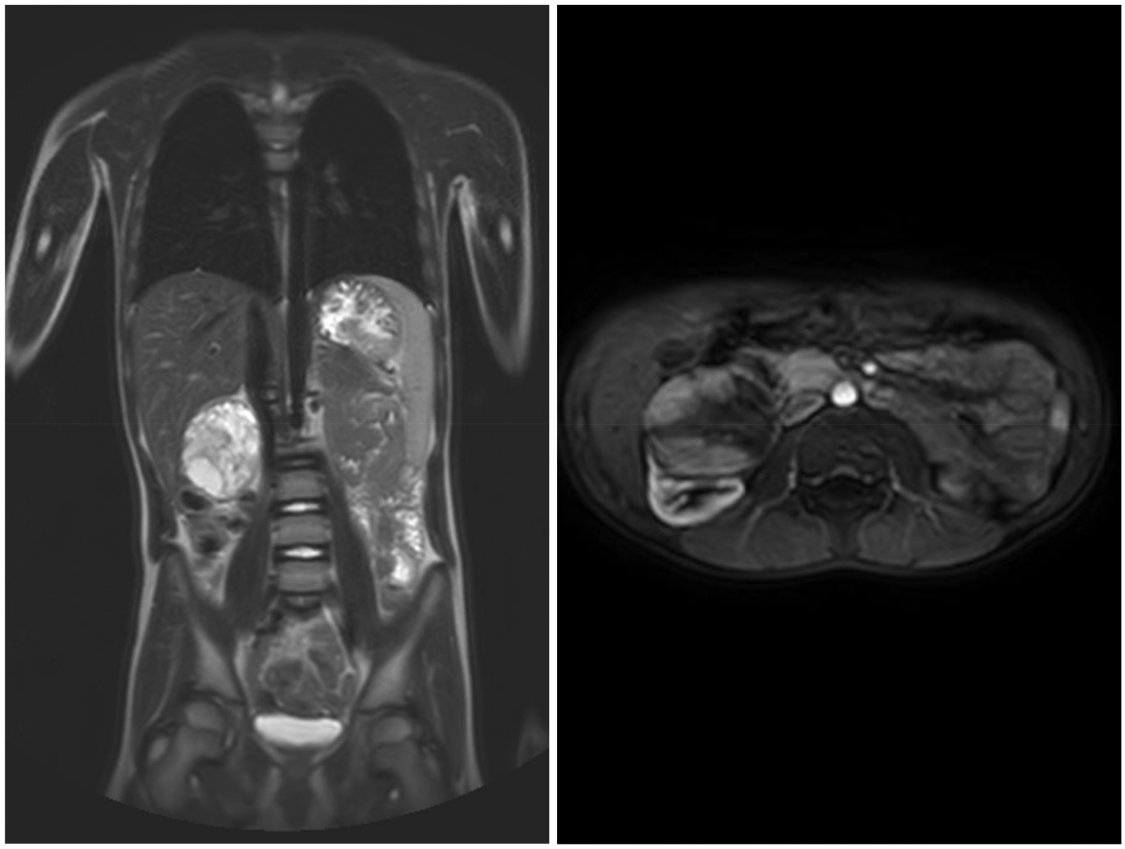

FIGURE 1
Metanephric adenoma in magnetic resonance image.

medical history did not reveal any specific findings. Abdominal ultrasonography (USG) showed a solid lesion in the lower pole of the right kidney, measuring 56 × 45 mm, with cystic necrotic areas. Contrast-enhanced abdominal magnetic resonance imaging (MRI) revealed a 56 × 51 mm exophytic mass located in the lower pole of the right kidney, exhibiting heterogeneous signal intensity, heterogeneous enhancement, and occasional diffusion restriction (Figure 1). The patient was started on preoperative vincristine treatment. A right nephroureterectomy was performed by the pediatric surgery department. Histopathological examination could not differentiate between metanephric adenoma (MA) and Wilms tumor. Immunohistochemical staining revealed WT1 (+), PANCK weak focal (+), INI1 intact, PAX8 (+), CD56 (+), CD57 (+), and synaptophysin (−) staining (Figures 2–4). The Ki67 proliferation index was 10%–12%. The pathology blocks were sent to a reference center for confirmation, where the upper central pathology was evaluated as MA. Immunohistochemical examination showed diffuse strong membranous staining with the CD57 antibody. To further confirm the diagnosis of MA, genetic testing was performed to detect the BRAF V600E mutation. Genetic results revealed the presence of the V600E (1799T > A) and V600E complex (1799_1800TG > AA) mutations. The patient was diagnosed with MA, and a plan was made for follow-up without chemotherapy.

Follow-up

The patient was diagnosed on July 18, 2023, and has been under regular follow-up for the past 22 months. The most recent abdominal ultrasonography, performed on February 19, 2025, confirmed the absence of the right kidney postoperatively. The left kidney measured 85 mm in the longitudinal axis, with a parenchymal thickness of 11 mm and normal echogenicity. No signs of dilation were observed in the collecting system. Laboratory investigations revealed a lactate dehydrogenase (LDH) level of 207 IU, which is within the normal reference range (110–295 IU). Urinalysis showed no erythrocytes or leukocytes. To date, there has been no evidence of metastasis or recurrence.

Although metanephric adenoma is typically associated with an excellent prognosis, isolated cases of metastatic progression have

Abbreviations
MA, metanephric adenoma; USG, ultrasonography; MRG, magnetic resonance imaging; WT, wilms tumor; LDH, lactate dehydrogenase.

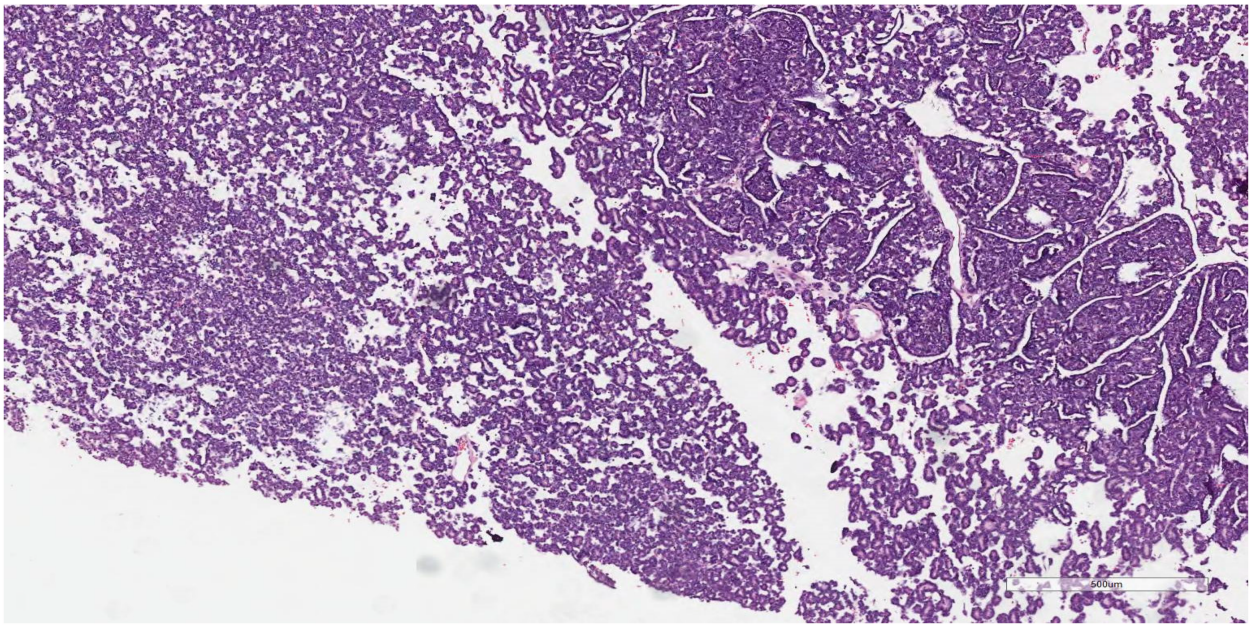

FIGURE 2
Hematoxylin-eosin (H&E) stained pathology section of metanephric adenoma. The section reveals clusters of atypical epithelial cells forming papillary or glandular structures (on the right side of the field). These cells exhibit features such as enlarged, hyperchromatic nuclei and occasional nuclear overlap, suggesting malignant transformation. The surrounding areas (on the left side) contain more loosely arranged cells and possible necrotic or hemorrhagic debris, indicating invasive growth into the adjacent tissue (Scale bar = 100 μm).

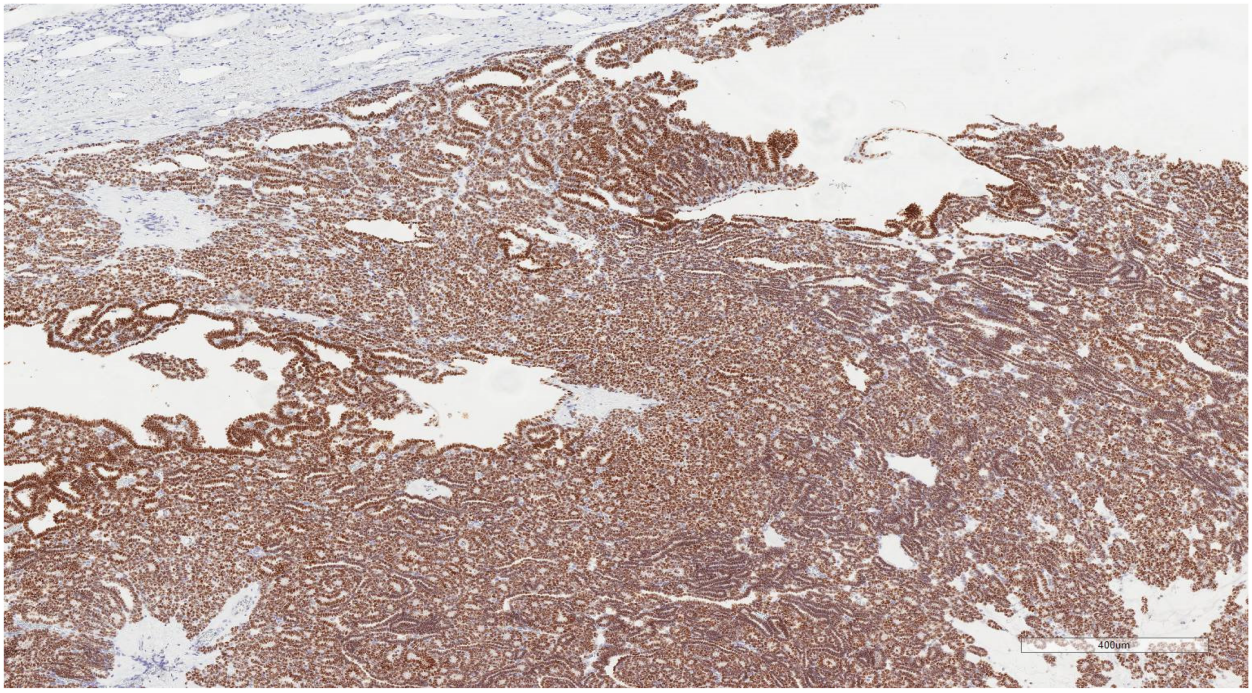

FIGURE 3
Wt1 immunohistochemical staining of metanephric adenoma. Diffuse and strong nuclear WT1 positivity is observed throughout the tumor tissue, confirming the diagnosis of metanephric adenoma. The staining pattern highlights the characteristic histological architecture of the tumor (Scale bar = 400 μm).

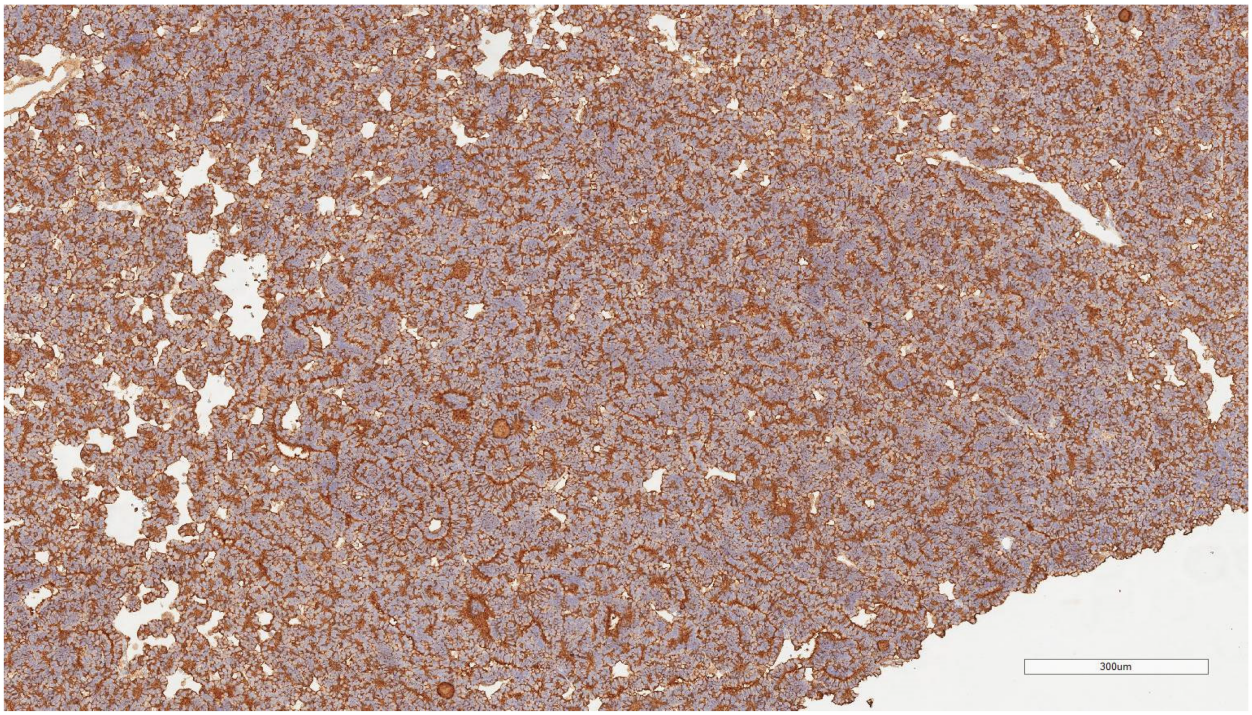

FIGURE 4
Cd57 immunohistochemical staining of metanephric adenoma. The tumor exhibits diffuse and strong membranous and cytoplasmic CD57 positivity, supporting the diagnosis of metanephric adenoma. The staining pattern highlights the characteristic cellular distribution within the tumor tissue (Scale bar = 300 μm).

been reported in the literatüre (9, 10). Therefore, ongoing surveillance remains essential. Our patient continues to be monitored at regular intervals, with no adverse clinical findings observed to date.

Discussion

Metanephric adenoma (MA) is a rare benign renal tumor with a typically slow clinical progression. While it is often asymptomatic, non-specific symptoms, such as abdominal pain, may occasionally be observed (9). MA constitutes approximately 0.2% of renal epithelial malignancies (11). Notably, the incidence of MA is higher in females compared to males (12). Although MA is most commonly diagnosed in adults, pediatric cases remain exceedingly rare (13). The radiological appearance of MA often mimics that of Wilms tumor (WT), which can complicate diagnosis (9). The presence of the BRAF V600E mutation is a distinguishing feature in about 90% of MA cases (14). Immunohistochemically, MA typically shows positivity for WT1 and CD57 (15), which is consistent with the findings in our case.

In a case series by Netto et al. (2007), a 2-year-old girl was diagnosed with MA, further emphasizing its rare presentation in the pediatric population (16). Similarly, de Jel et al. (17) detected the BRAF V600E mutation in three out of 41 MA cases, highlighting the importance of genetic testing in the diagnosis of this rare tumor. Furthermore, Mei et al. (18) followed a 2-year-old child with MA for 14 months and reported no recurrence or metastasis, reinforcing the generally indolent nature of this tumor in pediatric patients. Our case also demonstrated positivity for WT1 and CD57, with the BRAF V600E mutation confirmed genetically, further supporting the molecular characteristics of MA.

The genetic confirmation of MA, especially the detection of the BRAF V600E mutation, is essential for accurate diagnosis and management, particularly given its potential to be confused with more common renal tumors like Wilms tumor (19). Genetic and immunohistochemical evaluation are indispensable tools in diagnosing rare renal neoplasms such as MA, ensuring that appropriate treatment strategies are employed.

Conclusion

In the differential diagnosis of renal neoplasms in children, it is critical to consider MA, which may be mistaken for Wilms tumor due to their similar presentation. While MA remains exceedingly rare in the pediatric population, the importance of immunohistochemical evaluation and genetic testing for definitive diagnosis cannot be overstated. These diagnostic approaches ensure that MA is accurately identified and differentiated from other renal tumors, facilitating appropriate clinical management.

Data availability statement

The data is available upon reasonable request.

Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and the institutional requirements. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

ŞK: Conceptualization, Data curation, Investigation, Supervision, Writing – original draft, Writing – review & editing. BY: Conceptualization, Project administration, Software, Supervision, Writing – review & editing. AK: Data curation, Investigation, Project administration, Visualization, Writing – review & editing. ZT: Data curation, Formal analysis, Software, Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

References

1. Benson M, Lee S, Bhattacharya R, Vasy V, Zuberi J, Yasmeen S, et al. Metanephric adenoma in the pediatric population: diagnostic challenges and follow-up. *Urology*. (2018) 120:211–5. doi: 10.1016/j.urology.2018.06.042

2. Sarhan OM, Al Farhan A, Abdallah S, Al Ghwanmah H, Boqari D, Omar H, et al. Pediatric metanephric adenoma with Fanconi–Bickel syndrome: a case report and review of literature. *Surg Case Rep*. (2022) 8(1):1–5. doi: 10.1186/s40792-022-01435-4

3. Amin MB, Amin MB, Tamboli P, Javidan J, Stricker H, Venturina MDP, et al. Prognostic impact of histologic subtyping of adult renal epithelial neoplasms: an experience of 405 cases. *Am J Surg Pathol*. (2002) 26(3):281–91. doi: 10.1097/00000478-200203000-00001

4. Spaner SJ, Yu Y, Cook AJ, Boag G. Pediatric metanephric adenoma: case report and review of the literature. *Int Urol Nephrol*. (2014) 46:677–80. doi: 10.1007/s11255-013-0575-z

5. Özçakır E, Sancar S, Orcan GC, Erdoğan H, Orhaner B, Yalçın Ö, et al. Parsiyel nefrektomi ile tedavi edilen metanefrik adenom: Bir olgu sunumu.

6. Mosbahi S, Ben Youssef S, Zouaoui A, Abdelali M, Ben Fredj M, Ben Abdejelil N, et al. Metanephric adenoma diagnosed on biopsy in an infant: a case report. *J Med Case Rep*. (2023) 17(1):354. doi: 10.1186/s13256-023-04046-1

7. Choueiri TK, Cheville J, Palescandolo E, Fay AP, Kantoff PW, Atkins MB, et al. BRAF mutations in metanephric adenoma of the kidney. *Eur Urol*. (2012) 62(5):917–22. doi: 10.1016/j.eururo.2012.05.051

8. Hu S, Zhao Z, Wan Z, Bu W, Chen S, Lu Y. Chemotherapy combined with surgery in a case with metanephric adenoma. *Front Pediatr*. (2022) 10:847864. doi: 10.3389/fped.2022.847864

9. Rodríguez-Zarco E, Machuca-Aguado J, Macías-García L, Vallejo-Benítez A, Ríos-Martín JJ. Metanephric adenoma: molecular study and review of the literature. *Oncotarget*. (2022) 13:387. doi: 10.18632/oncotarget.28192

10. Picken MM, Curry JL, Lindgren V, Clark JI, Eble JN. Metanephric adenosarcoma in a young adult: morphologic, immunophenotypic, ultrastructural, and fluorescence *in situ* hybridization analyses: a case report and review of the literature. *Am J Surg Pathol*. (2001) 25(11):1451–7. doi: 10.1097/00000478-200111000-00016

11. Takezawa Y, Izumi K, Ikeda H, Nakano T, Konaka H, Mizokami A, et al. Metanephric adenoma treated with laparoscopic nephrectomy: a case report. *Mol Clin Oncol*. (2017) 7(3):404–6. doi: 10.3892/mco.2017.1327

12. Saremian J, Kubik MJ, Masood S. Cytologic features of metanephric adenoma of the kidney: case report and review of the literature. *Lab Med*. (2015) 46(2):153–8. doi: 10.1309/LMW2MHDM6EILGQH2

13. Mremi A, Bodganowics J, Sadiq A, Tadayo J, Lodhia J. A giant metanephric adenoma in a young male. *J Surg Case Rep*. (2023) 2023(4):rjad187. doi: 10.1093/jscr/rjad187

14. Ding Y, Wang C, Li X, Jiang Y, Mei P, Huang W, et al. Novel clinicopathological and molecular characterization of metanephric adenoma: a study of 28 cases. *Diagn Pathol*. (2018) 13(1):1–14. doi: 10.1186/s13000-018-0732-x

15. Udager AM, Pan J, Magers MJ, Palapattu GS, Morgan TM, Montgomery JS, et al. Molecular and immunohistochemical characterization reveals novel BRAF mutations in metanephric adenoma. *Am J Surg Pathol*. (2015) 39(4):549–57. doi: 10.1097/PAS.0000000000000377

16. Netto JMB, Esteves TC, Mattos RDCMS, Tibiriçá SHC, Costa SMCR, Vieira LJ. Metanephric adenoma: a rare differential diagnosis of renal tumor in children. *J Pediatr Urol*. (2007) 3(4):340–1. doi: 10.1016/j.jpurol.2006.10.003

17. De Jel DV, Hol JA, Ooms AH, de Krijger RR, Jongmans MC, Littooij AS, et al. Paediatric metanephric tumours: a clinicopathological and molecular characterisation. *Crit Rev Oncol Hematol*. (2020) 150:102970. doi: 10.1016/j.critrevonc.2020.102970

18. Mei H, Zheng L, Zhou C, Tong Q. Metanephric adenoma in a 2-year-old child: case report and immunohistochemical observations. *J Pediatr Hematol Oncol*. (2010) 32(6):489–93. doi: 10.1097/MPH.0b013e3181e34de1

19. Yin X, Zhang X, Pan X, Tan J, Zheng L, Zhou Q, et al. Atypical metanephric adenoma: shares similar histopathological features and molecular changes of metanephric adenoma and epithelial-predominant Wilms' tumor. *Front Oncol*. (2022) 12:1020456. doi: 10.3389/fonc.2022.1020456