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CASE REPORT

# An unusual cause of renal vein thrombosis in a newborn: COVID-19

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**Abstract**
There is no information on renal vein thrombosis induced by COVID-19 infection in a neonate. Few cases of renal vein thrombosis caused by COVID-19 infection have been reported in predominantly adult patients. On day 25 after birth, a newborn whose mother was infected with COVID-19 had renal vein thrombosis. We believed that our patient's renal vein thrombosis was caused by postnatal transmission of the COVID-19 infection that the mother had acquired during birth. The clinical and radiologic findings of these unusual renal complications in a neonate, as well as treatment options, are presented.

**Keywords** Renal vein thrombosis · Newborn · COVID-19

## Introduction

Renal vein thrombosis occurs for almost one-fifth of all neonatal thromboembolic events. The majority of newborns are diagnosed within the first 3 days of life. Thrombosis is mostly unilateral in two-thirds of cases, and left kidney involvement is more likely [1–3]. Maternal and neonatal risk factors can both contribute to the development of renal vein thrombosis in newborns [4]. Renal vein thrombosis has recently been documented in mostly adult patients with COVID-19 infections in the literature. It usually occurs 2 weeks to 3 months after the onset of symptoms [5–10]. The neonatal experiences are mostly linked to babies born to mothers infected with COVID-19 during pregnancy [11–14]. Transfer of IgG through the placenta and IgA through breast milk protects the newborn in infected mothers with COVID-19 by providing passive immunization [15]. Although the majority of babies delivered to COVID-19-infected mothers are asymptomatic, there have been few reports of neonates having clinical signs such as multisystem inflammatory syndrome in children (MIS-C) or thromboembolic consequences such as leg gangrene [16–18]. However, there have been no reports of neonates having renal vein thrombosis following the COVID-19 infection.

In this report, we discuss the diagnosis, clinical history, and treatment options for COVID-19-associated neonatal renal vein thrombosis.

## Case report

The patient was admitted to our hospital at 3 months of age to determine the cause of renal vein thrombosis and to decide whether anticoagulation therapy should be continued. In his medical history, the baby was born vaginally at term to a 39-year-old mother in another center. His mother was infected with COVID-19 at delivery. She developed a fever and upper respiratory tract infection symptoms. Her SARS-CoV-2 PCR from a nasopharyngeal swab sample was positive. She had no history of vaccination. As a result of the COVID-19 infection, the patient's mother did not breastfeed. The patient's mother had no history of diabetes, hypertension, or chronic health problems, and the patient had no history of hospitalization for asphyxia, sepsis, or umbilical catheter insertion after birth. On day 25 after birth, he developed only hematuria. On admission, his creatinine was found to be high as 3.38 mg/dL (normal range: 0.16–0.39 mg/dL), the platelet level was 57,000/μL (normal range: 244,000–529,000/ μL), and the D dimer value was 1.05 μg/mL (normal range: 0–0.5 μg/mL). A renal Doppler ultrasound was performed to determine the

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etiology of renal failure, which revealed diffuse unilateral renal thrombosis that extended to the superior vena cava, and subcutaneous therapy with low-molecular-weight heparin (LMWH) at two doses of 100 IU/kg was initiated. The patient was hospitalized for 20 days, his creatinine level returned to normal, and he was discharged with LMWH follow-up. When the patient arrived at our hospital at the age of 3 months, his laboratory results were as follows: creatinine: 0.42 mg/dL, hemoglobin: 9.4 g/dL (normal range: 9.6–12.4 g/dL), platelets: 397,000/µL, white blood cells: 9200/µL (normal range: 6510–13,320/µL), and absolute neutrophil count: 2100/µL (normal range: 970–5450/µL). Complete urinalysis was normal. Antithrombin 3 activity was 81% (normal range: 50–150%), protein S was 96% (normal range: 65–140%), protein C was 62% (normal range: 70–130%), Factor Xa was 1 UI/mL (therapeutic range: 0.5–1 UI/mL), prothrombin time was 12.7 s (normal range: 10.5– 14.5 s), INR was 1.09 (normal range: 0.8–1.2 INR), fibrinogen was 237 mg/dL (normal range: 200–400 mg/dL), D dimer was 0.5 µg/mL, and aPTT was 37.6 s (normal range: 20–30 s). Only methylenetetrahydrofolate reductase (MTHFR) heterozygosity in A1298C was identified as a hereditary thrombophilia risk factor. Homocysteine level was 8 µmol/L (normal range: 6–15 µmol/L). At 3 months old, the patient tested positive for anti-SARS-CoV-2 IgM and negative for anti-SARS-CoV-2 IgG antibodies to the nucleocapsid protein. The anti-SARS-CoV-2 IgG (ECLIA) titer was 83.65 BAU/ml. An ultrasound scan revealed a 4 × 3.5 mm echogenic thrombus in the left renal vein, extending into the superior vena cava (Fig 1). The left kidney (35 × 20 mm) had become atrophied, while the right kidney (58 × 24 mm) had compensated by hypertrophy. The patient developed intestinal bleeding during the 10th week of treatment with LMWH, and we could not determine whether this was drug-induced bleeding or cow's milk protein allergy; therefore, the LMWH treatment was discontinued. His coagulation test results, including INR, were within normal limits. At 1-month follow-up, the patient's general health was good, there was no increase in creatinine and D-dimer values, and there was no progression on the control Doppler ultrasonography.

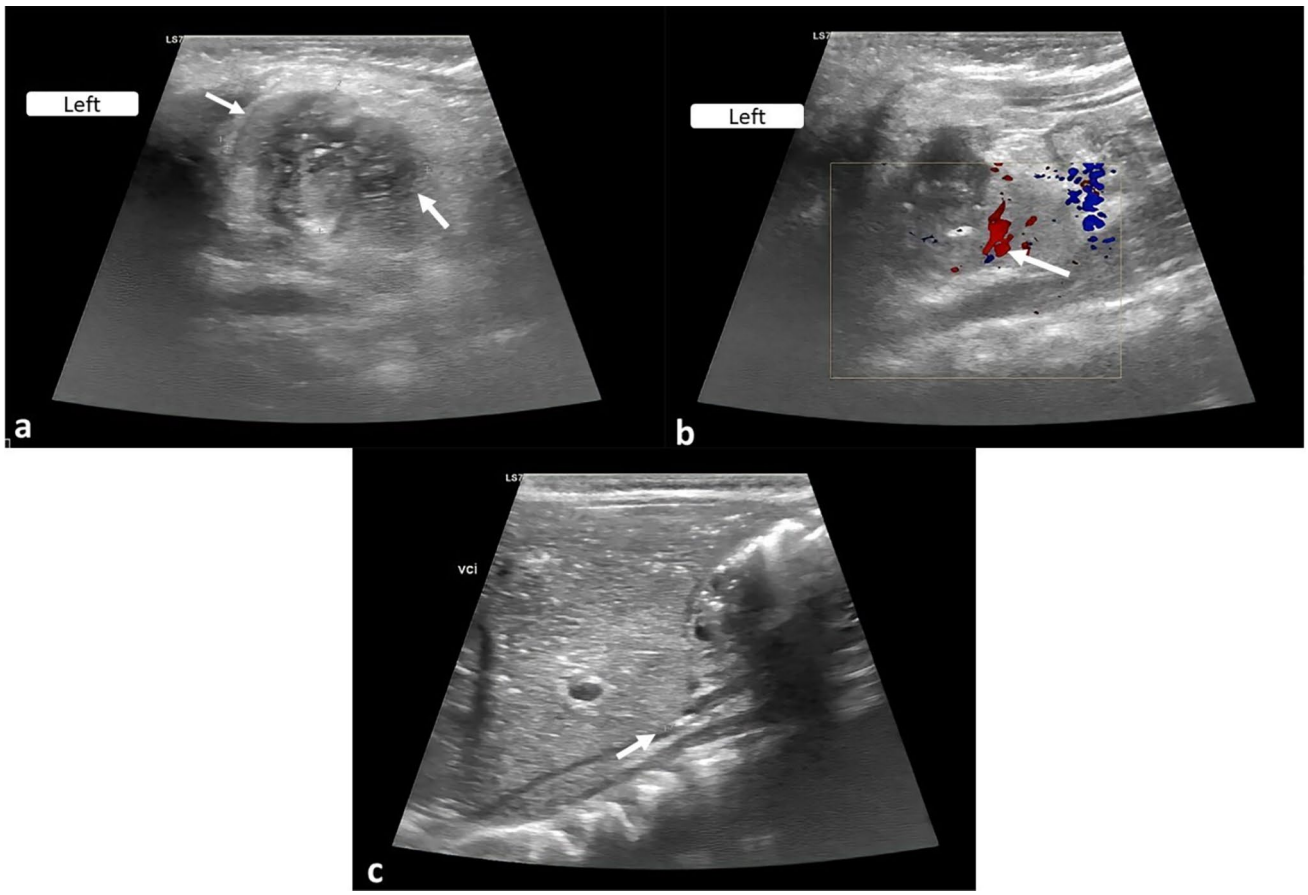


**Fig. 1** **a** The left kidney has a calcified heterogeneous region (white arrows) that is not vascularized on Doppler imaging, and (**b**) Doppler ultrasound at the left lower pole of the kidney shows arterial flow (white arrow), (**c**) there is a calcified thrombus (white arrow) in the inferior vena cava that does not obstruct the lumen and allows flow

## Discussion

Renal vein thrombosis in the neonatal period accounts for 16–20% of all thromboembolic events, and 75–80% of newborns are diagnosed within the first 3 days [1–3]. Prematurity, congenital heart disease, respiratory distress syndrome, sepsis, perinatal asphyxia, and dehydration are the most common neonatal risk factors contributing to renal vein thrombosis, while maternal diabetes mellitus, preeclampsia, and infections are the most common maternal risk factors [4]. We ruled out maternal and neonatal risk factors for renal vein thrombosis. The patient's mother had no health problems, and the patient had no history of hospitalization for asphyxia, sepsis, or umbilical catheter insertion. Our case was asymptomatic during the early neonatal period but developed renal vein thrombosis on postnatal day 25. Factor V Leiden mutation is among the most commonly reported inherited risk factors, and it has been reported that the presence of MTHFR mutation combined with homocysteine elevation may rarely contribute to the development of thrombosis [19]. Our patient only had an MTHFR heterozygous mutation and normal homocysteine levels, indicating that the thrombosis was not caused by an inherited risk factor. The mother in our case had COVID-19 during labor, suggesting that the virus was transmitted by direct contact after birth. In infected mothers, the transfer of IgG through the placenta and IgA through breast milk protects the newborn by providing passive immunization [15]. Although IgA transmission through breast milk and IgG transmission across the placenta have been reported, it was thought that adequate IgG transmission through the placenta to the fetus could not be provided in our case because the mother was infected with COVID-19 during delivery [15]. As the patient was never breastfed due to her mother's COVID-19 infection, passive immunization with breast milk was also not considered. There is only one case in the literature of a newborn patient who developed spike-specific anti-SARS-CoV-2 antibodies at 2 months of age after postnatal exposure to COVID-19, which is consistent with the presence of IgG antibodies in our patient at 3 months, supporting the possibility of an early antibody response [15]. Our patient was exposed to COVID-19 in the early neonatal period and tested positive for anti-SARS-CoV-2 IgG antibody at 3 months of age, indicating that the patient developed his immune response and that the thrombosis was most likely secondary to COVID-19 infection.

Infants whose mothers were infected with COVID-19 during pregnancy have an increased risk of premature birth [11, 12]. In COVID-19-positive pregnant women, microthrombi in placental structures that provide fetomaternal connection increase the risk of premature delivery requiring cesarean section. Preterm birth is three times more common in COVID-19-infected mothers than that in healthy mothers [11]. Infants born to mothers infected with COVID-19 during labor were mostly asymptomatic, with only a few showing MISC-like symptoms [16–18]. In addition, the development of gangrene in the leg of a newborn patient who had COVID-19 during the neonatal period suggests that thromboembolic complications due to COVID-19 may rarely occur during the neonatal period [17]. In the literature, renal vein thrombosis caused by COVID-19 infection has often been documented between 2 weeks and 3 months after the onset of symptoms [5–10]. Similarly, our patient was diagnosed with renal vein thrombosis on postnatal day 25 after a history of maternal COVID-19 infection. In neonates, renal vein thrombosis in 70% of cases is unilateral, with the left kidney being the most commonly affected [1–3]. Accordingly, renal vein thrombosis in the presented case was unilateral, and the left kidney was atrophic.

Thrombolytic therapy is recommended in the early stages of bilateral renal vein thrombosis and unilateral thrombosis extended to the superior vena cava, according to thrombosis guidelines. [20]. The likelihood of renal atrophy in the absence of thrombolytic therapy is reported to be 75–85%, whether anticoagulant therapy is used or not [21, 22]. Low-molecular-weight heparin is usually given for 3 to 6 months [20]. Renal vein thrombosis has been associated with a 12.4-fold increase in the risk of chronic renal failure and a 15.7-fold increase in the risk of chronic hypertension [4]. The case we presented was diagnosed in another center, and thrombolytic therapy was not administered. On the contrary, a decrease in creatinine levels and an improvement in urine color after LMWH treatment suggest that the thrombosis responded well only to anticoagulant therapy. He had been using anticoagulation therapy for at least 10 weeks before the treatment was discontinued due to intestinal bleeding. In his follow-up, no recurrence of thrombosis was found.

To the best of our knowledge, this is the first case report in the literature of a newborn with COVID-19-induced renal vein thrombosis, with a discussion of the diagnosis, treatment, and follow-up.

## Declarations

**Conflict of interest** The authors have declared that no conflict of interest exists.

**Human and animal participation** This article does not contain any studies with human participants or animals performed by any of the authors.

**Informed consent** Informed consent was obtained from the parents.

## References


1. Lau KK, Stoffman JM, Williams S, et al. Neonatal renal vein thrombosis: review of the English-language literature between 1992 and 2006. Pediatrics. 2007;120:e1278–84.
2. Kuhle S, Massicotte P, Chan A, Mitchell L. A case series of 72 neonates with renal vein thrombosis. data from the 1–800-NO-CLOTS registry. Thromb Haemost. 2004;92:729–33.
3. Haley KM. Neonatal Vein Thromboembolism. Front Pediatr. 2017;5:136.
4. Ouellette AC, Darling EK, Sivapathasundaram B, et al. Incidence, risk factors, and outcomes of neonatal renal vein thrombosis in Ontario: population-based cohort study. Kidney. 2020;360(1):640–7.
5. Songtanin B, Attaya E, Nugent K. Extensive thrombosis of the inferior vena cava and bilateral renal veins in a COVID-19 patient. Am J Med Sci. 2023;366:e66–7.
6. Petrou D, Sardeli A, Vlachoyiannopoulos P, Moschovaki-Zeiger O, Lionaki S. Acute renal vein thrombosis following COVID-19 in a lupus patient: a case report and review of the literature. Life (Basel). 2023;13:1252.
7. Janbazi Roudsari H, Negaresh M, Shirzadeh V, Mohammadzadeh Germi B, Mirzaei A. Renal vein thrombosis after COVID-19: A case report. Clin Case Rep. 2022;10: e6778.
8. Asleson L, Zalabani M, Selim M. A case of renal vein thrombosis associated with COVID-19 treated with rivaroxaban. Cureus. 2022;14: e29491.
9. Mirfakhraee H, Saghafian Larijani S, Zandieh Z, et al. Renal vein thrombosis in a recent COVID-19 patient; a case report. J Renal Inj Prev. 2022. https://doi.org/10.34172/jrip.2022.31997.
10. Middeldorp S, Coppens M, van Haaps TF, et al. Incidence of vein thromboembolism in hospitalized patients with COVID-19. J Thromb Haemost. 2020;18:1995–2002.
11. Moore KM, Suthar MS. Comprehensive analysis of COVID-19 during pregnancy. Biochem Biophys Res Commun. 2021;538:180–6.
12. Chi J, Gong W, Gao Q. Clinical characteristics and outcomes of pregnant women with COVID-19 and the risk of vertical transmission: a systematic review. Arch Gynecol Obstet. 2021;303:337–45.
13. Wang CL, Liu YY, Wu CH, Wang CY, Wang CH, Long CY. Impact of COVID-19 on pregnancy. Int J Med Sci. 2021;18:763–7.
14. Vigil-Vázquez S, Carrasco-García I, Hernanz-Lobo A, et al. Impact of gestational COVID-19 on neonatal outcomes. Pediatr Infect Dis J. 2022;41:466–72.
15. Conti MG, Terreri S, Piano Mortari E, et al. Immune response of neonates born to mothers infected with SARS-CoV-2. JAMA Netw Open. 2021;4: e2132563.
16. Gámez-González LB, Escrcega-Jurez AS, Aguilar-Soto DE, Colmenero Rascón M, García Espinosa AC, Yamazaki-Nakashimada MA. Multisystem inflammatory syndrome in neonates associated with SARS-CoV-2 infection, a different entity? J of Neonatal-Perinat Med. 2022. https://doi.org/10.3233/NPM-220990.
17. Sajjan DGR, Sajjan DKR. A case report on vertical transmission of Covid-19 presenting as gangrene of lower limb in neonate. Int J Clin Obstet Gynaecol. 2020;4:65–6.
18. Amonkar PS, Gavhane JB, Kharche SN, Kadam SS, Bhusare DB. Aortic thrombosis in a neonate with COVID-19-related fetal inflammatory response syndrome requiring amputation of the leg: a case report. Paediatr Int Child Health. 2021;41:211–6.
19. Kosch A, Kuwertz-Bröking E, Heller C, Kurnik K, Schobess R, Nowak-Göttl U. Renal vein thrombosis in neonates: prothrombotic risk factors and long-term follow-up. Blood. 2004;104:1356–60.
20. Moores LK, Tritschler T, Brosnahan S, Carrier M, Collen JF, Doerschug K, Holley AB, Jimenez D, Le Gal G, Rali P, Wells P. Prevention, diagnosis, and treatment of VTE in patients with coronavirus disease 2019: CHEST guideline and expert panel report. Chest. 2020;158:1143–63.
21. Messinger Y, Sheaffer JW, Mrozek J, Smith CM, Sinaiko AR. Renal outcome of neonatal renal vein thrombosis: review of 28 patients and effectiveness of fibrinolytics and heparin in 10 patients. Pediatrics. 2006;118:e1478–84.
22. Bidadi B, Nageswara Rao AA, Kaur D, Khan SP, Rodriguez V. Neonatal renal vein thrombosis: role of anticoagulation and thrombolysis–an institutional review. Pediatr Hematol Oncol. 2016;33:59–66.