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Antiphospholipid syndrome presenting as isolated renal vein thrombosis: a case report and review of the literature

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Abstract

Background Pediatric antiphospholipid syndrome is a rare systemic autoimmune disorder characterized by recurrent thrombotic events in the presence of antiphospholipid antibodies. Isolated right renal vein thrombosis resulting in a nonfunctional kidney is an uncommon manifestation of antiphospholipid syndrome. Here, we present our experience with antiphospholipid syndrome secondary to systemic lupus erythematosus.

Case presentation A 10 year-old girl from a Hindu family in Sindh, Pakistan, who had previously been healthy, presented in 2020 with a 1-week history of abdominal pain, gross hematuria, vomiting, and fever. On examination, she was anxious, febrile, hypertensive, and had an enlarged, tender right kidney. Other systemic examinations, including skin, locomotor, respiratory, cardiovascular, and nervous systems, were unremarkable.

Initial investigations for ureteric colic and acute pyelonephritis were negative, but revealed thrombocytopenia on complete blood count, mild proteinuria, hematuria on urinalysis, and normal kidney and liver function tests, along with normal prothrombin and activated partial thromboplastin times. An abdominal ultrasound showed a diffusely enlarged, echogenic right kidney with a loss of corticomedullary distinction and cortical hypoechoic areas, while the left kidney appeared normal. Color Doppler ultrasound identified a large thrombus in the right renal vein, completely obstructing its lumen and showing no blood flow. The thrombus extended into the inferior vena cava. Computed tomography angiography confirmed an organized thrombus completely blocking the right renal vein and extending into the infrahepatic portion of the inferior vena cava. No prothrombotic risk factors were identified during clinical evaluation, and thrombophilia screening was negative. However, lupus serology and antiphospholipid antibodies were positive, confirming a diagnosis of secondary antiphospholipid syndrome.

Management and outcome The patient was treated with enoxaparin anticoagulation, later transitioned to warfarin sodium, and her hypertension was managed with captopril and amlodipine. She showed gradual improvement over 10–12 days and was discharged on anticoagulants, antihypertensive medications, antiplatelet agents, and hydroxychloroquine.

A follow-up Doppler ultrasound revealed persistent blockage of the right renal vein by the thrombus, with no thrombus in the inferior vena cava. A dimercaptosuccinic acid scan indicated a nonfunctioning right kidney. While nephrectomy was recommended, her parents declined the procedure. Anticoagulation therapy was switched to rivaroxaban to avoid frequent international normalized ratio monitoring. Her captopril was replaced after control of blood pressure with losartan.

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Over the next 4 years, her follow-up was uneventful. She demonstrated normal growth, stable blood pressure (off antihypertensive), and normal kidney function without proteinuria. There were no lupus flares or thrombotic recurrences. Her most recent urinalysis was normal, with a serum creatinine level of 0.6 mg/dL and an estimated glomerular filtration rate > 170 mL/min/1.73 m^2.

Conclusion Isolated renal vein thrombosis is a rare presentation of antiphospholipid syndrome and poses a diagnostic challenge in the absence of preexisting prothrombotic risk factors. Early diagnosis and timely management are crucial to prevent organ damage. In this case, the patient retained a solitary functioning kidney. Long-term follow-up is essential to monitor for lupus flares, thrombus recurrence, hypertension, proteinuria, and progression to chronic kidney disease, as well as to ensure continued thromboprophylaxis.

Keywords Renal vein thrombosis, Antiphospholipid antibodies, Systemic lupus erythematosus, Enoxaparin, Children

Background

Pediatric antiphospholipid syndrome (pAPS) is an acquired systemic autoimmune disorder characterized by recurrent thrombotic events in patients with persistently positive antiphospholipid antibodies (aPL) [1, 2]. APS can be classified as primary when it occurs in isolation, or secondary when associated with another autoimmune condition. Both forms can be observed in children. In 21% of cases, primary APS may evolve into a secondary form, often due to the development of an autoimmune disorder such as systemic lupus erythematosus (SLE) during the course of the illness [3]. The catastrophic form (CAPS) of APS is a life-threatening, rapidly progressing type characterized by generalized antibody-mediated thrombi affecting multiple organ systems, often triggered by infection [2].

Pediatric APS is rare but can affect individuals of all age groups, ranging from neonates to adolescents up to 18 years [1–3]. It commonly occurs between the ages of 9 and 14 years. In the largest international registry of 121 cases, the mean age of onset was 10.7 years [3]. The most recent prevalence reported in Italy is 2.5 cases per 100,000 people, with a mean age of 15.1 ± 2.8 years [4]. Unlike in adults, where there is a significant gender predominance (a male-to-female ratio of 1:5), there is no such gender bias in pediatric APS [4]. Renal vein thrombosis, a very rare manifestation of APS, has been reported in only one or two cases in large series [3, 5].

Antiphospholipid antibodies (aPL) play a central role in the pathogenesis of APS and SLE. aPL bind to β2-glycoprotein I (β2GPI), a major target antigen on the cell surface. This binding upregulates prothrombotic cellular adhesion molecules, interacts with interferon pathways, and activates both the classical and leptin complement systems [5, 6]. aPL can induce a proliferative and hypercoagulable state by activating the mammalian target of rapamycin (m-TOR) pathway in endothelial cells, platelets, and monocytes [7].The use of m-TOR inhibitors as antithrombotic therapies in vasculopathy and APS suggests an important role for m-TOR in their pathogenesis [7–9].

APS may present as asymptomatic aPL positivity, non-criteria manifestations, vascular thromboembolism, or, rarely, as CAPS [2–5, 10]. Evidence of venous, arterial, or microvascular thrombosis in the index case raises suspicion of APS. Renal artery and renal vein thrombosis, hypertension, APS-associated nephropathy, and chronic kidney disease (CKD) are common renal manifestations [2, 5]. The persistent presence of aPLs (≥ 12 weeks), such as lupus anticoagulant (LA), anticardiolipin antibodies (aCL), and anti-β2-glycoprotein I antibodies (anti-β2GP1), is the diagnostic hallmark of APS when accompanied by thrombotic events [1–6]. Although antiphosphatidylserine/prothrombin antibodies (aPS/PT) and antibodies against β2GPI-D1 (anti-D1) have emerged to help stratify the risk of recurrence and detect seronegative APS, they are not yet routinely used [6, 7]. It is crucial to exclude associated conditions, including autoimmune, neoplastic, or infectious diseases, to distinguish primary from secondary APS [2].

Management of APS is multifactorial and depends on the type of presentation. It typically includes anticoagulation, antiplatelet agents, immunosuppressive therapy, endovascular interventions, treatment of the underlying cause, and patient education regarding the risk of recurrence and the need for long-term thromboprophylaxis [1, 2, 7, 11].

This case report follows the CARE guidelines and was approved by the Kidney Centre Ethical Review Committee (166-PNEPH-022024 [EXEMPTION]) for publication [12]. We present the case of a child with APS and isolated right renal vein thrombosis secondary to SLE, managed at a tertiary kidney care center in Karachi, Pakistan.

Case presentation

We present a case of a 10-year-old girl from a low socioeconomic background in a Hindu family from Sindh, Pakistan, who initially presented to our Pediatric Urology Clinic and was later transferred to Pediatric Nephrology

Care. She presented with a 1-week history of severe right lumbar pain, gross hematuria, vomiting, and fever. The pain was severe enough to require pain relief medication, and she visited the emergency room 2–3 times before being admitted for hospitalization. She did not report any burning sensation during urination, dysuria, urinary retention, or incontinence. There were no other systemic manifestations, such as joint pain, prolonged fever, alopecia, mouth ulcers, or skin rash.

She was born by C-section to unrelated parents, and her early childhood was uneventful. She was fully immunized and developmentally normal. She is currently a student in the 8th grade. Her past medical and drug history was unremarkable, and there was no family history of kidney disease or other systemic disorders at the time of presentation. On examination, she appeared anxious and unwell, febrile (101°F), and hypertensive, with a systolic and diastolic blood pressure of 130/96 mmHg, which was above the 95th percentile for her age and height.

Her anthropometric measurements were as follows: weight 36.4 kg (50th percentile), height 141 cm (above the 50th percentile), and body surface area (BSA) 1.2 m^2 . She was mildly anemic and dehydrated, but not jaundiced. No rashes or lymphadenopathy were observed. Abdominal examination revealed tenderness in the right lumbar region, but there was no splenomegaly. Her respiratory and cardiovascular systems were normal, and locomotor and neurological examinations were unremarkable. Initially, a diagnosis of ureteric calculus and/or acute pyelonephritis was suspected.

Initial laboratory results showed (Table 1) a hemoglobin (Hb) level of 12.4 g/dL, white blood cell count of 14.98×10^9/L, and platelet count of 75×10^9/L. Urinalysis (Table 1) revealed a reddish, hazy appearance with 150 mg/dL protein, 3 + blood, numerous red blood cells (RBCs) and white blood cells (15–20/hpf), while leukocyte esterase and nitrites were negative. The spot urine calcium-to-creatinine ratio was 0.06 (normal < 0.2), and the protein-to-creatinine ratio was 0.8 (normal < 0.2). Table 1 also shows biochemistry and cultures. Renal function was normal, with urea at 12 mg/dL, creatinine at 0.33 mg/dL, and electrolytes within normal limits.

Table 1 Laboratory diagnostic work-up before admission and during the hospital stay

Month	February 2020		March 2020						
Date	24	28	3	4	6	7	8	11	12
Hospital status	OPD	ERV	In-patient						
Complete blood counts									
Hb (11.5–15.5 g/dL)	12	10.8	11.2		9.5		8.6	9.3	9.3
WBC ($4.0–10.0\times10^9$/L)	14.96	11.98	20.4	84	16.0		15.8	8.9	10.7
Platelets ($150–400\times10^9$/L)	75	50	69		124		135	189	200
CRP (< 6 mg/L)			45				48		6
Urinalysis									
Color	Reddish		Yellow			Yellow			
pH 4.6–7.4	6.0		6.5			7.0			
Protein (< 10 mg/dL)	150		150			75			
Ketones (< 5 mg/dL)	150		15			– ve			
Blood	3 +		3 +			3 +			
Nitrite (–ve)	–ve		–ve			–ve			
LE (< 10 leuk/μL)	25		25			–ve			
RBCs (< 5/hpf)	Numerous		Numerous			Numerous			
WBCs (< 5/hpf)	15–20		1–2			Occ			
suCaCR (mg/mg 0.2)			0.06						
suPCR (mg/mg 0.2)							1.0		
Biochemistry									
Cr (0.6–0.9 mg/dL)	0.33	0.54				0.4			
Na (136–149 mEq/L)					137	135			
K (3.8–5.2 mEq/L)					3.9	3.8			
Cl (98–107 mEq/L)					102	100			
HCO_3 (25–29 mEq/L)					26	31			

OPD, outpatient department; ERV, emergency room visit; Hb, hemoglobin; WBCs, white blood count; CRP, C-reactive protein; LE, leukocyte esterase; RBCs, red blood cells; suCaCR, spot urine calcium–creatinine ratio; suPCR, spot urine protein–creatinine ratio; Cr, creatinine

Liver function tests and coagulation profiles were normal as well. The serum lipase level was normal, but her serum albumin was slightly low (2.98 g/dL), and dengue serology was negative. Her C-reactive protein level was elevated at 48 mg/dL, lactate dehydrogenase (LDH) was 696 U/L, and D-dimer was significantly raised at 19.8 mg/L. Her blood and urine cultures were negative. The sequential diagnostic radioimaging is shown in Table 2. Ultrasound (US) revealed a diffusely enlarged right kidney (11.5 cm × 6.7 cm) with patchy areas of increased echogenicity, while the left kidney appeared normal. A color Doppler study showed a hypoechoic thrombus in the right renal vein (RRV, Fig. 1a) that completely blocked blood flow and extended into the inferior vena cava (IVC, Fig. 1b). Renal computed tomography angiography (Fig. 2) confirmed these findings, showing an enlarged, edematous right kidney with a well-organized hypodense thrombus completely obstructing the RRV, extending into the IVC.

Her work-up for hereditary thrombophilia (including protein-C, protein-S, antithrombin III, and factor V Leiden) was negative (Table 3). Further serological testing (Table 4) confirmed a diagnosis of systemic lupus erythematosus (SLE), evidenced by low complement-3 (C3), positive antinuclear antibodies (ANA) with a titer of 1/5120, and positive anti-ds DNA antibodies. In addition, tests for antiphospholipid syndrome (APS) showed positive anticardiolipin antibodies (IgG and IgM), lupus anticoagulant, and prolonged confirmatory tests, which confirmed APS as secondary to SLE.

The patient was initially managed with intravenous paracetamol, hydration, and antibiotics. Her hypertension was controlled with oral captopril and amlodipine, and captopril was later switched to losartan. She was anticoagulated with low-molecular-weight (LMW) heparin (enoxaparin) and later switched to oral warfarin after 6 days. The clinical, diagnostic, and treatment course is summarized in Fig. 3. Her condition improved over 8–10 days, with her platelet count rising to 189×10^9/L. She was discharged after 12 days on warfarin, with strict observation for bleeding and regular monitoring of her prothrombin time and international normalized ratio (PT-INR) (Fig. 4), aiming to maintain a target INR of 2–3. She continued amlodipine and losartan for hypertension and proteinuria, along with hydroxychloroquine (200 mg) and acetylsalicylic acid (75 mg) for thrombosis prevention.

We closely monitored her for signs of pulmonary embolism owing to the risk of embolization from the IVC thrombus, but no such signs were observed. Immunosuppressive therapies, such as corticosteroids, were not considered as there were no systemic manifestations of SLE or lupus nephritis at that time.

Follow-up and subsequent management (Table 5)

Initially, the patient was closely monitored in the outpatient department with regular checks on her blood pressure (BP), clinical symptoms (such as pain and gross hematuria), prothrombin time (PT) with international normalized ratio (INR), and complete blood count (CBC) to monitor thrombocytopenia; color Doppler ultrasound (US) for recanalization of the affected veins; serum creatinine (Cr) for kidney function; and a dimercaptosuccinic acid (DMSA) renal scan to assess right kidney function. Her echocardiogram did not reveal any valvular defects or vegetation. A repeat color Doppler US during follow-up showed persistence of the right renal vein (RRV) thrombus but resolution of the inferior vena cava (IVC) thrombus (Fig. 1c). The DMSA renal scan revealed a nonfunctioning right kidney, which was recommended for nephrectomy; however, the parents chose not to pursue this option.

Table 2 Diagnostic workup: sequential radioimaging

Date	Type of imaging	Results/interpretation
3 March 2020	US kidneys	Right kidney (RK) 11.5 cm × 6.7 cm, Left kidney 10.0 cm × 4.3 cm RK is diffusely swollen, with patchy areas of increased echogenicity and loss of cortico-medullary distinction
5 March 2020	Color Doppler US (Fig. 1a, b)	On color doppler study, a hypoechoic thrombus (2.8 cm) within the right renal vein (RRV) causing complete obstruction. This thrombus extends from the RRV into the IVC causing partial obstruction
10 March 2020	CT angiograph (Fig. 2a–c)	On the arterial phase, the RK appears enlarged and edematous. On the venous phase, an organized hypodense thrombus in the RRV, completely obliterating its lumen, and extending into the IVC. On sagittal view, the thrombus extends until the infrahepatic part of the IVC
17 April 2020	Repeat color Doppler US	A large hypoechoic thrombus is completely blocking the right RV. There is a resolving thrombus in IVC (Fig. 1c)
	Echocardiograph	All chambers are normal with an ejection fraction of 71% No intracardiac shunt. No valvular abnormalities or vegetations
30 May 2020	DMSA scan	Nonfunctioning right kidney

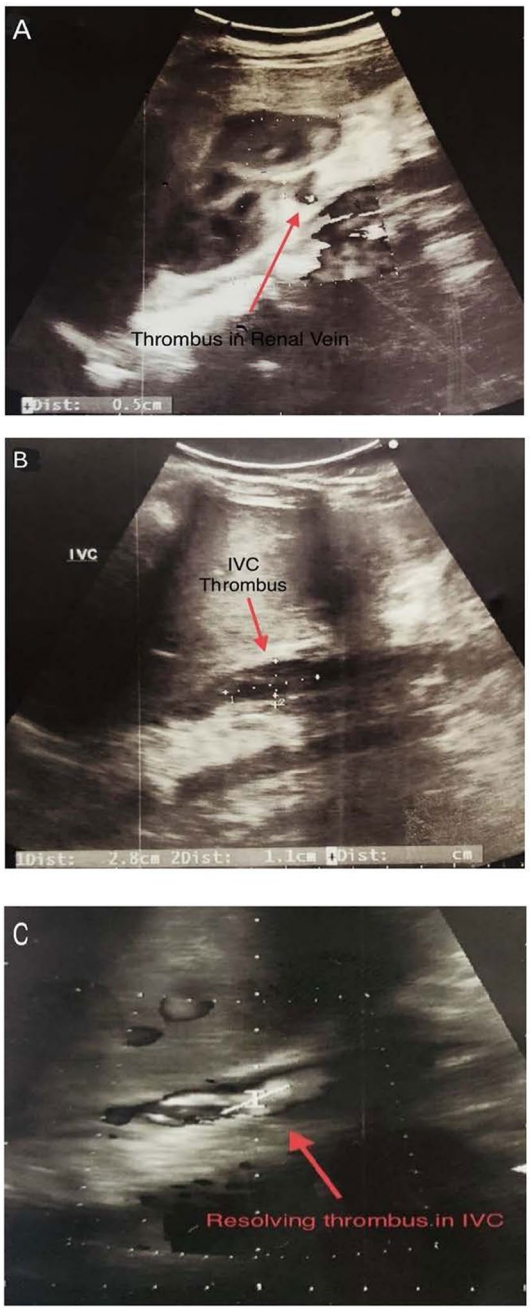

Fig. 1 **a** Color Doppler image showing a hypoechoic thrombus in the right renal vein **b** Color Doppler image showing a thrombus in the inferior vena cava. **c** Resolving thrombus in the inferior vena cava. Red arrow indicates site of abnormality

Four weeks after discharge, the patient contracted chickenpox but recovered smoothly without complications. We lost contact with the patient from November 2020 to September 2021 owing to the coronavirus disease 2019 (COVID-19) pandemic. During this period, she visited another healthcare center where her anticoagulant treatment, warfarin, was replaced with rivaroxaban (10 mg once daily) to avoid the need for frequent INR monitoring. During her subsequent follow-up visits, we monitored her growth (height and weight), hypertension (BP), kidney function (serum Cr), proteinuria (spot urine protein-to-creatinine ratio, suPCR), and hematuria (urinalysis) monthly for 3 months. She also underwent two ophthalmological reviews to check for hydroxychloroquine (HCQ)-associated retinopathy, which were both normal. We continued to monitor her clinically for lupus flare-ups, recurrence of thrombosis, and performed serial ultrasounds to assess the size of her right kidney.

Her recent follow-up showed a weight of 56.9 kg, height of 160 cm, body mass index (BMI) of 22.7 kg/m^2 (85th percentile), and a blood pressure of 120/70 mmHg (off amlodipine but continuing with losartan). Her kidney function was normal, with a serum creatinine of 0.6 mg/dL and an estimated glomerular filtration rate (eGFR) of > 170 ml/min/1.73 m^2. However, she had slightly low hemoglobin (9.9 g/dL), a normal white blood cell (WBC) count (9.59×10^9/L), and a normal platelet count (418×10^9/L). Fortunately, she did not develop any further complications; however, she experienced menorrhagia, which resulted in anemia (Hb 9.9 g/dL). This was managed by consultation with a gynecologist, who adjusted her rivaroxaban dosage to 5 mg/day and prescribed 250 mg of tranexamic acid three times a day for 3–5 days during her menstrual period. We also tested her complement C3 (1.02 g/L) and anti-ds DNA levels (8.86 IU/mL), both of which were normal, indicating no active lupus.

Her most recent ultrasound of the kidneys showed a small, shrunken, and echogenic right kidney (5.7 cm × 1.8 cm), with a compensatory enlargement of the left kidney (12.5 cm × 5 cm).

We plan to continue her anticoagulation, antiplatelet therapy, angiotensin receptor blockers (ARB), and hydroxychloroquine (HCQ) on a long-term basis, potentially for life. We also consulted a rheumatologist regarding the duration of anticoagulation therapy, but no decision has yet been made regarding discontinuation. Unfortunately, her mother developed systemic lupus erythematosus (SLE) 18 months later, and she is currently under the care of a rheumatologist.

Discussion and conclusions

Antiphospholipid syndrome (APS) is a rare autoimmune disorder characterized by recurrent arterial and venous thrombosis, pregnancy-related complications, and the persistence of antiphospholipid (aPL) antibodies for at least 12 weeks [1].The diagnosis of pediatric APS is not well defined, and there are no validated criteria for this age group [2, 6, 10]. This is particularly

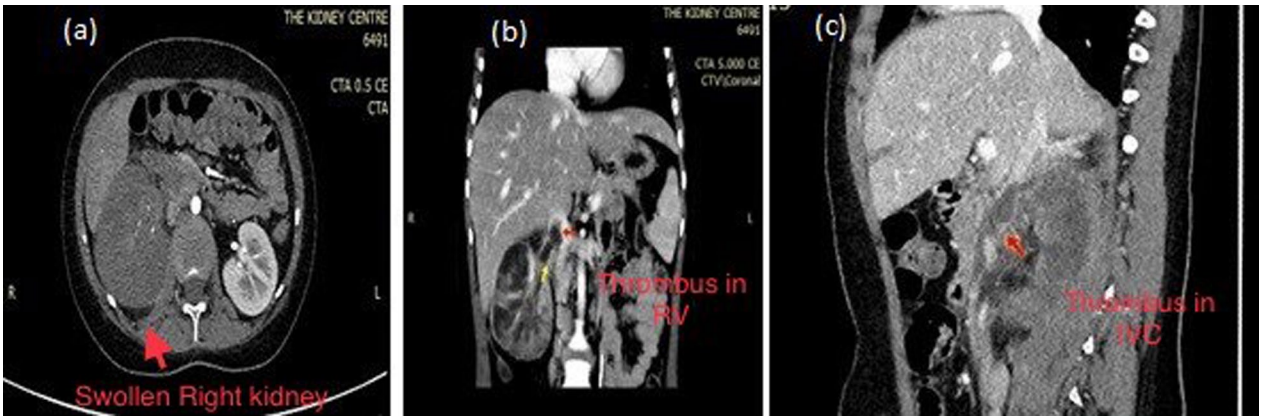

Fig. 2 **a** Computed tomography angiography in the arterial phase showing an enlarged, swollen right kidney with loss of corticomedullary differentiation. **b** Computed tomography angiography showing an organized echodense thrombus in the venous phase, obstructing the right renal vein and extending to the inferior vena cava. **c** Ccomputed tomography angiography in the sagittal view of the venous phase image showing the extension of the thrombus from the right renal vein into the inferior vena cava to the infrahepatic level

Table 3 Diagnostic work-up: inherited thrombophilia

Variable	Patient's value (%)	Normal value (%)
Plasma protein-C	110	70–140
Plasma protein-S	57	56–121
Plasma anti-thrombin III	111	74–126
Factor V Leiden	140	62–150

true for our patient, who presented with isolated renal vein thrombosis (RVT) and thrombocytopenia, a non-classical criterion of APS [9–11]. This rare presentation of secondary APS, particularly in association with systemic lupus erythematosus (SLE), has been previously documented. For instance, a similar case involved a school-aged girl who, after a minor injury, was initially diagnosed with renal contusion but later found to have renal vein and inferior vena cava thrombosis (Fig. 5A, B). She subsequently developed pulmonary emboli, massive proteinuria, hypoalbuminemia, hypercholesterolemia, and nephrotic syndrome, and, after 5 years, was diagnosed with secondary APS [14]. Secondary APS is reported in 69% of SLE cases and is more common in girls [5]. Although C-reactive protein (CRP), D-dimer, and lactate dehydrogenase (LDH) were mildly elevated in our patient, her initial prothrombin time (PT) and activated partial thromboplastin time (APTT) were normal.

Table 4 Diagnostic work-up: lupus serology and antiphospholipid syndrome

Variable	Patient's value	Normal value	Interpretation
Lupus serology			
Complement C3 (g/L)	0.6	0.8–1.5	Positive
Antinuclear antibody, homogeneous pattern (est. end titer 1/5120)			Positive
Anti-smooth muscle antibody			Negative
Anti-mitochondrial antibody			Negative
Anti-ds-DNA (IU/mL)	30.2	< 20	Positive
Antiphospholipid antibodies			
aCL-ab IgG (GPL/mL)	10.44	≤ 10	Positive
aCL-ab IgM (MPL/mL)	> 9.25	< 5	Positive
Lupus anticoagulant			
LA screen(s)	91.6	31–44	Strongly positive
LA confirmatory(s)	42.2	30–38	
LA screen–confirmatory ratio	2.2	0.8–1.2	
D-dimer (mg/L FEU)	19.8	< 0.5	Positive

aCL-ab, anticardiolipin antibody

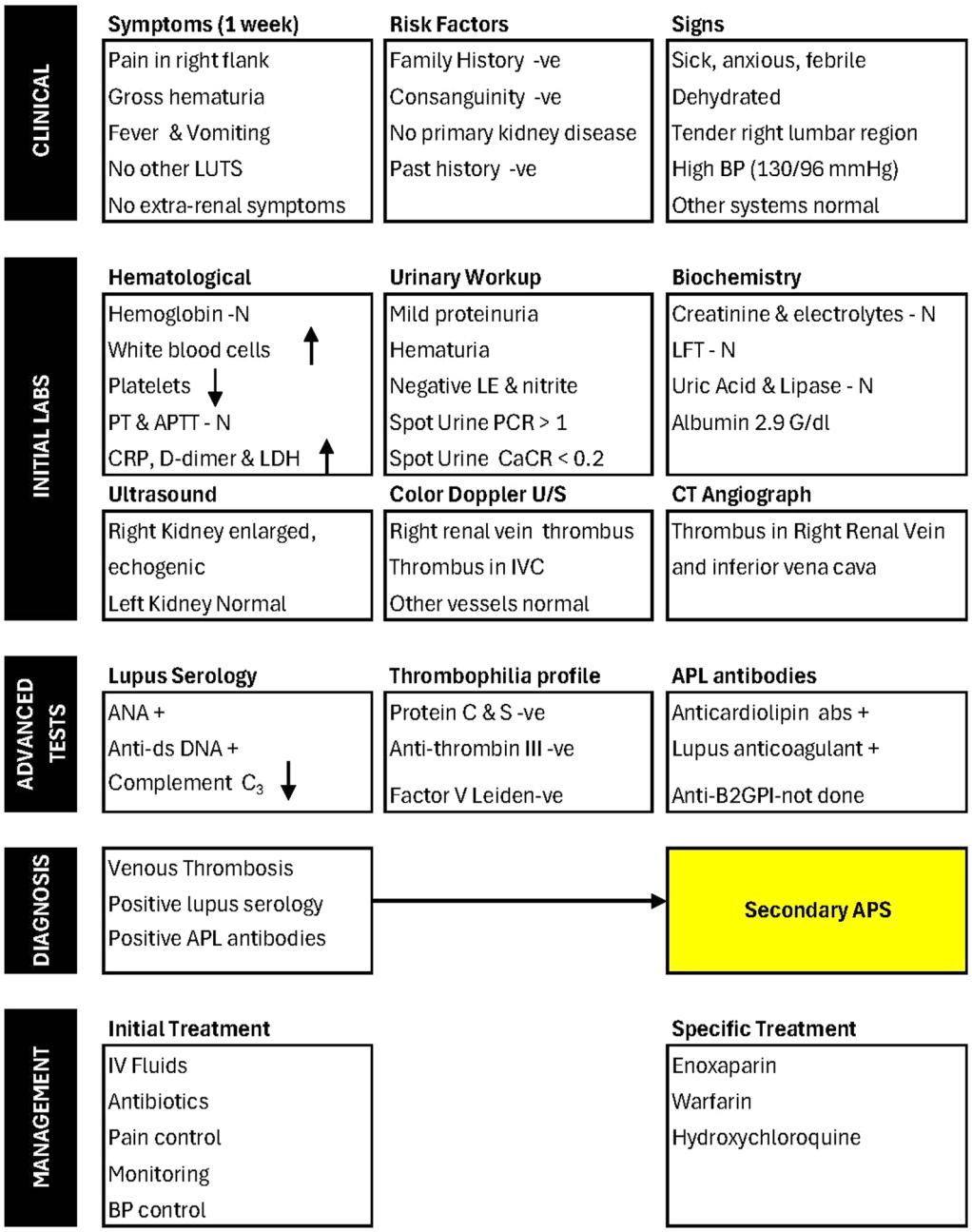

Fig. 3 Summary of diagnosis and initial treatment

Prolonged APTT is considered a potential screening marker for thrombosis, as shown by Torres-Jimenez *et al.*, who reported its positivity in 93% of cases [14]. However, this was not helpful in our patient. CRP, D-dimer, and LDH are nonspecific markers for thrombosis [14]. Positive triple aPL testing is recommended for the definitive diagnosis of both primary and secondary APS [2, 6, 10]. In our patient, aPL positivity, along with positive lupus serology, confirmed the diagnosis of secondary APS. The largest cohort of pediatric APS, reported from 14 countries, included 121 patients with a mean age of onset of 10.7 years, consistent with our patient, who was 10 years old [3]. Venous thrombosis is more common (60%) than arterial thrombosis (32%) in children with APS, and deep vein thrombosis in the lower limbs is the most frequent presentation [3, 10, 13–15]. Our patient, however, presented with acute abdominal pain, gross hematuria, and fever, initially raising suspicion of

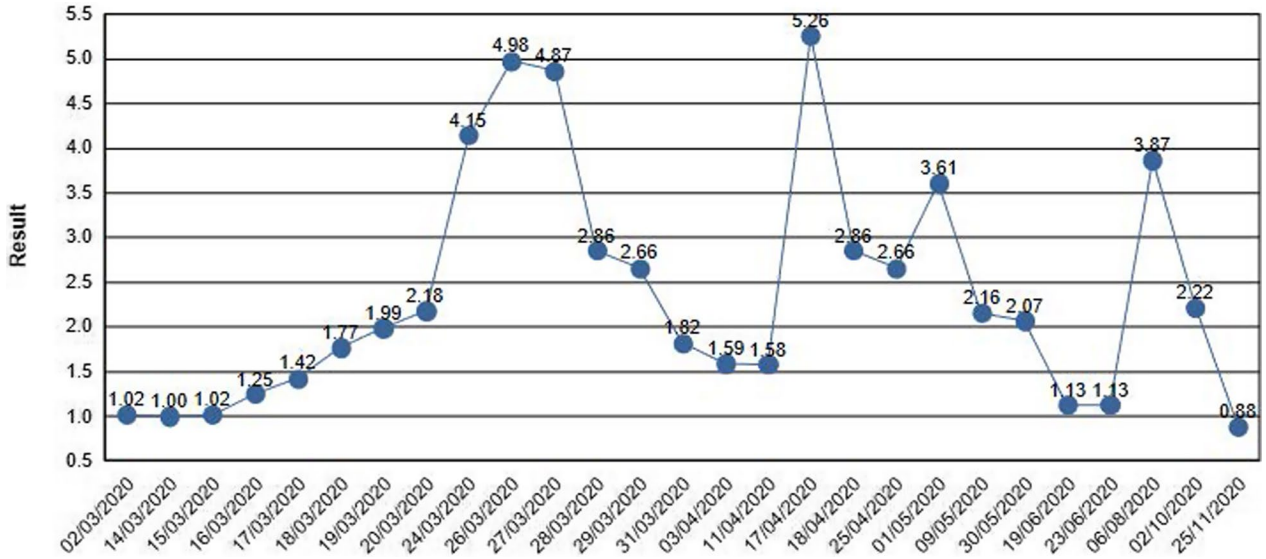

Fig. 4 Serial international normalized ratios while on warfarin therapy

Table 5 Clinical and laboratory follow-up data of this case

Follow-up	2020					2021		2022		2023		2024
Month	April	May	August	October	November**	September**	December	February	July	January	October	March
Weight (kg)	37.7	38	37	38	39	44	46	48	51	57	56	59
Height (cm)	142	142	143	144	145	148	152	153	156	157	160	160
Systolic BP	120	110	110	98	96	110	107	110	117	120	120	125
Diastolic BP	80	60	66	64	64	55	66	70	70	75	80	70
Hb (g/dL)	10.4	11.1	12.3	12.5	11	11.5	11.3	11.8	11.8	11.6	10.3	9.9
WBC (10^9/L)	7.2	9.35	12.03	8.81	11.3	10.28	10.5	9.64	11.86	13.4	9.81	9.59
Platelets (10^9/L)	107	94	130	212	134	196	300	372	304	463	405	418
Urinalysis and suPCR remain normal throughout follow-up												
Serum creatinine remain with in normal levels throughout follow-up												
PT-INR is shown in Fig. 4 while on warfarin							On rivaroxaban					
C-reactive protein remained within normal limits												
SGPT (U/L)	24	–		20								
Complement C3 (g/L)										1.02		
Anti-dsDNA (IU/mL)										8.86		
Ultrasound kidneys			Right kidney 5.7 cm × 1.8 cm, small, echogenic, loss of CMD. Left kidney 12.5 cm × 5 cm, compensatory enlargement									

Hb, hemoglobin; WBC, white blood cell count; PT, prothrombin time; INR, international normalized ratio; suPCR, spot urine protein: creatinine

** lost to follow-up

acute ureteric colic or pyelonephritis. However, investigations including urinalysis, urine and blood cultures, and ultrasound did not reveal any evidence of stone diseases or pyelonephritis, resulting in a delay in diagnosis. Once radioimaging, including color Doppler ultrasound and CT angiography, confirmed the diagnosis of RVT, we proceeded to determine the underlying cause and ultimately confirmed secondary APS through positive lupus serology and aPL antibodies. The two–three aPLA positivity for diagnosis of APS, such as in our case, has also been reported in recent local studies [16, 18].

Endothelial damage, stasis, and a hypercoagulable state are the three primary mechanisms for thrombus formation in APS. Recent literature has highlighted the role of anti-β2-glycoprotein I (anti-β2GPI) autoantibodies and aPL, alongside the involvement of neutrophils,

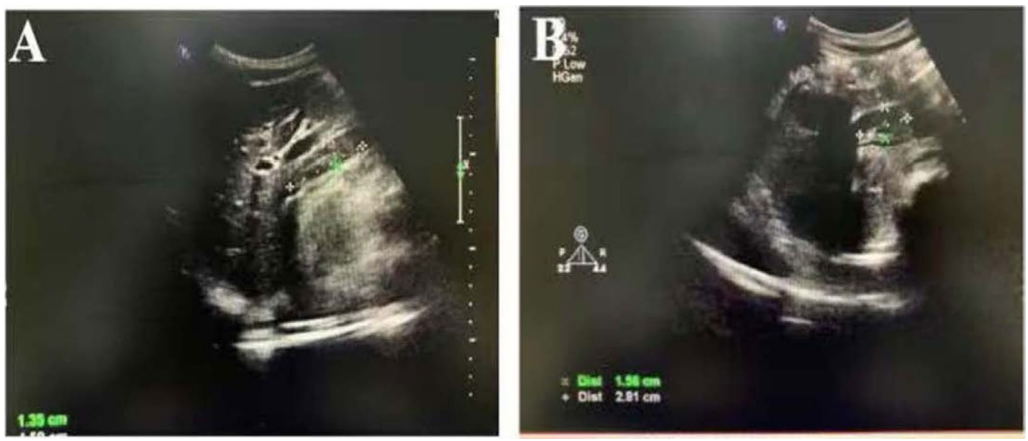

Fig. 5 Color Doppler image showing (**A**) right renal vein and (**B**) inferior vena cava thrombus (from 14)

monocytes, platelets, endothelial cells, and prothrombotic states induced by interferon and complement pathways [6, 7]. Both APS and lupus are forms of autoimmune vasculitis that lead to RVT, with endothelial damage and hypercoagulation induced by aPL antibodies playing key roles [5, 15, 16]. APS is the most common cause of spontaneous RVT, found in 1–5% of healthy individuals and 35–40% of patients with SLE, similar to our case [13, 16]. In our patient, two aPL antibodies were positive, although anti-β2GPI was unavailable for testing at the time. A similar case of nonfulfillment of all three aPL diagnostic criteria has been reported in the literature [18–20]. We also faced financial constraints that prevented us from repeating aPL testing after 12 weeks to fulfill the Sapporo criteria, a critical component in diagnosing adult APS [2, 7, 11]. However, given the clinical scenario, confirmation of venous thrombus through color Doppler and CT angiography, along with positive serology for SLE, negated any alternative diagnoses.

There are several prothrombotic conditions more common in adults, such as smoking, obesity, hypertension, and pregnancy, but none were identified in our patient [12, 17, 19]. In the absence of specific diagnostic tests and with clinical manifestations still developing, imaging modalities such as CT angiography, which provides 100% sensitivity and specificity, remain the investigation tools of choice [20]. In our case, routine ultrasound revealed an enlarged and echogenic kidney, suggesting the early phase of acute RVT, while color Doppler ultrasound indicated reduced blood flow in the right renal vein, which was confirmed by CT angiography, showing RVT and inferior vena cava involvement.

The primary treatment goal for pediatric APS patients is managing acute thrombotic events and preventing thrombosis recurrence [2, 6, 7]. The standard guidelines recommend acute management typically with low-molecular-weight heparin (LMWH), followed by maintenance with long-term vitamin K antagonists (warfarin) [11, 15, 21]. In our case, we initially anticoagulated with enoxaparin, as per the SHARE recommendations, and later switched to warfarin sodium with a PT-INR target of 2.0–3.0. However, we eventually transitioned to rivaroxaban, a newer oral anticoagulant, owing to its proven safety and effectiveness in treating acute venous thromboembolism and thromboprophylaxis in children [22, 23]. Thrombocytopenia is a relevant noncriteria manifestation of APS, observed in 20–25% of children with APS [10, 16]. While thrombocytopenia usually does not require treatment, we refrained from using acetylsalicylic acid until the platelet count normalized [10]. The recurrence of thrombotic events are common in primary and secondary APS in adults (40–45%) and in children with lupus-associated APS (11%) [20, 24]. Patients with triple aPLA have the highest risk of recurrence compared with single antibody positivity and lupus anticoagulant positivity [25]. Our patient did not experience a recurrence of thrombotic events or relapse of SLE during follow-up. The use of continuous anticoagulants, low-dose acetylsalicylic acid, and hydroxychloroquine likely contributed to preventing recurrence. The development of SLE in the mother after 18 months suggests a potential familial lupus association, although genetic testing was not available to confirm this [26]. The hyperfunctioning left kidney in our patient, with an eGFR > 170 ml/min/1.73 m^2, is consistent with the effects of hyperfiltration and glomerular hypertension, which can lead to glomerulosclerosis and chronic kidney disease (CKD) [27]. To manage this, we continued losartan, an angiotensin receptor blocker, to control hyperfiltration and prevent CKD progression.

In conclusion, the isolated presentation of RVT in a child without pre-existing prothrombotic conditions is a diagnostic challenge, particularly in developing countries such as Pakistan. However, with appropriate management, our patient responded well, and long-term follow-up is necessary to monitor for recurrence of thrombosis, lupus flares, and the progression of kidney disease. We plan to continue monitoring and managing her condition, ensuring thromboprophylaxis, controlling hypertension, proteinuria, and safeguarding the function of her solitary kidney.

Abbreviations

CT-angiography	Computed tomography angiography
DMSA scan	Dimercaptosuccinic acid scan
APS	Antiphospholipid syndrome
aPL	Antiphospholipid antibodies
aCL	Anticardiolipin antibody
LA	Lupus anticoagulant
anti-β2GPI	Anti-beta 2-glycoprotein 1
ANA	Antinuclear antibodies
Anti-ds DNA	Anti-double-stranded deoxyribonucleic acid
m-TOR inhibitors	Mammalian target of rapamycin inhibitors
RVT	Renal vein thrombosis
SLE	Systemic lupus erythematosus
C3	Complement component-3
LDH	Lactate dehydrogenase
PT	Prothrombin time
APTT	Activated partial thrombin time

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Author contributions
KNM planned, prepared, wrote the case report, and approved the study. SK collected clinical and laboratory details, searched for references, and drafted the manuscript.

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Availability of data and materials
The pertinent data used in the present study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
Data were obtained from The Kidney Centre Ethical Review Committee, Karachi Pakistan, vide letter no. 166-PNEPH-022024 (EXEMPTION).

Consent for publication
Written informed consent was obtained from the patient's legal guardian for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
The authors declare that they have no competing interests.

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