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Life-Threatening Retroperitoneal Hemorrhage Following Cyst Rupture in Autosomal Dominant Polycystic Kidney Disease (ADPKD): A Case Report

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Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Patient: Male, 60-year-old
Final Diagnosis: Retroperitoneal hemorrhage
Symptoms: Altered mental status • lethargy
Clinical Procedure: —
Specialty: Nephrology

Objective: Congenital defects/diseases

Background: Autosomal dominant polycystic kidney disease (ADPKD) is the leading genetic cause of kidney failure worldwide. It is characterized by cyst formation and growth, kidney parenchymal destruction, and complications including cyst infection, nephrolithiasis, cyst rupture, and cyst hemorrhage. Cyst bleeding is typically a self-limited event. This case report describes a 60-year-old man with ADPKD admitted with retroperitoneal hemorrhage following renal cyst rupture requiring embolization of a bleeding left lumbar artery and use of tranexamic acid.

Case Report: A 60-year-old man with ADPKD presented with altered mental status. Labs noted hemoglobin of 4.7 g/dL. Abdominal imaging revealed polycystic kidneys and large left retroperitoneal hematoma. Angiogram demonstrated active bleeding from left L3 lumbar artery which was embolized. He was admitted to intensive care unit for hemorrhagic shock requiring multiple blood transfusions. Hemoglobin continued to downtrend despite blood products with repeat imaging demonstrating expanding retroperitoneal bleed. He underwent repeat angiogram and though there was no active bleeding, prophylactic embolization of left L1, L3, L4 lumbar and left renal capsular arteries were performed. Hemoglobin stabilized for next 3 days but continued to downtrend subsequently. Oral tranexamic acid was trialed with stabilization of the hemoglobin.

Conclusions: Life-threatening retroperitoneal hemorrhage following cyst rupture in the absence of major trauma or use of anti-coagulants, is a rare complication in ADPKD. Treatment involves resuscitation with blood products, management of shock, and interventional radiology-guided embolization. Tranexamic acid may be considered when the above measures fail. Nephrectomy may be indicated for refractory bleeding. This report highlights the diagnosis and management of massive cyst bleeding in ADPKD.

Keywords: Hemorrhage • Polycystic Kidney Diseases • Tranexamic Acid

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/938889

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Background

Autosomal dominant polycystic kidney disease (ADPKD) is the leading genetic cause of kidney failure worldwide [1]. It is characterized by relentless cyst formation and growth, kidney parenchymal destruction, and complications including cyst infection, nephrolithiasis, cyst rupture, and cyst hemorrhage [2-5]. Cyst hemorrhage often presents with flank pain or gross hematuria and is usually self-limited resolving within a week with conservative therapy [5]. Rarely, ruptured cysts can present with gross hematuria or life-threatening retroperitoneal hemorrhage requiring prompt management [5]. This report presents the case of a 60-year-old man with ADPKD admitted with retroperitoneal hemorrhage and hemorrhagic shock following renal cyst rupture requiring embolization of a bleeding left lumbar artery and use of tranexamic acid.

Case Report

A 60-year-old man with a past medical history of chronic kidney disease secondary to autosomal dominant polycystic kidney disease (ADPKD) and hypertension presented to the hospital with chief concerns of lethargy, chest pain, and altered mental status for 1 day. A review of systems reported by the family was notable for shortness of breath, abdominal pain, decreased appetite, and intermittent nausea and vomiting, with symptoms starting about 7 to 10 days prior to arrival to the hospital. He had not received any medical care in the last several years and has not been followed by a nephrologist. On initial presentation, he was tachycardic (heart rate of 125 beats per minute), hypotensive (blood pressure of 105/53 mmHg), and hypoxic (oxygen saturation of 66% on room air requiring non-breather). Physical examination demonstrated a pale, lethargic, disoriented patient with tachypnea and accessory muscle use, tachycardia without heart murmurs, and abdominal distention with diffuse tenderness and guarding. His initial laboratory evaluation revealed severe anemia with hemoglobin of 4.7 g/dL (reference range 13.2 to 16.6 g/dL) and hematocrit of 13.4% (reference range 38.3% to 48.6%), hyponatremia with serum sodium of 125 mEq/L (reference range 135 to 145 mEq/L), severe high anion gap metabolic acidosis with a serum total CO2 of less than 5 mmol/L (reference range 22 to 29 mmol/L), serum lactate of 3.3 mmol/L (reference range 0.5 to 2.2 mmol/L), profound azotemia with a blood urea nitrogen of 217 mg/dL (reference range 8 to 24 mg/dL), and serum creatinine of 17.1 mg/dL (reference range 0.74 to 1.35 mg/dL), with an unclear prior baseline. An arterial blood gas following intubation noted pH of 7.09 (reference range 7.35 to 7.45), PaCO2 of 23 mmHg (reference range 35 to 48 mmHg) with a corresponding total carbon dioxide of 7 mEq/L on labs, most consistent with severe metabolic acidosis.

On hospital day 1, he required intubation and mechanical ventilation for acute hypoxemic respiratory failure. He was admitted to the Intensive Care Unit (ICU) for the management of shock requiring vasopressor support with norepinephrine and vasopressin. A contrast-enhanced computed tomography (CECT) of the abdomen and pelvis showed enlarged polycystic kidneys, with more than 10 cysts on each kidney, consistent with ADPKD along with 3 soft-tissue masses in the lower left abdomen, the largest of which measured 15.9×9.4 cm in diameter, concerning for retroperitoneal hematomas from a ruptured hemorrhagic renal cyst (**Figure 1**). His total kidney volume (TKV) on imaging excluding the hemorrhagic cyst was 5744 mL, consistent with Mayo Imaging Class 1D. A massive transfusion protocol was initiated, and he was transfused 7 units of packed red blood cells and 6 units of fresh frozen plasma. Due to concern for active bleeding, he was taken to an Interventional Radiology (IR) suite, and he underwent left renal, lumbar, ileal lumbar artery angiogram. He was noted to have active bleeding from the left L3 lumbar artery, which was embolized with Gelfoam.

He was initiated on continuous kidney replacement therapy with continuous venovenous hemofiltration (CVVH) for oliguric kidney failure and severe metabolic acidosis. He was eventually extubated, with improvement in hemodynamics and respiratory failure. CVVH was stopped and he was transitioned to intermittent hemodialysis, then he was transferred to the medical floor.

Hemoglobin trended down over the next several days, requiring an additional 4 units of blood transfusions over 6 days (**Figure 2**). Due to further concern for bleeding, he underwent a repeat CT angiogram of the abdomen and pelvis, which demonstrated increased size of the left retroperitoneal hematoma without evidence of active bleeding. On hospital day 7, he underwent a repeat IR angiogram and Gelfoam embolization of the left L1, L3, and L4 lumbar arteries and left renal capsular artery **(Figure 3)**. He was closely monitored following repeat embolization. Hiss hemoglobin continued to trend down, and he required another 2 units of blood transfusions over the next 3 days. Given persistent bleeding and failure of IR embolization, a trial of oral tranexamic acid (1300 mg once daily for 9 days) was initiated after discussion of risks and benefits. On dialysis days, tranexamic acid was given after hemodialysis. Following anti-fibrinolytic therapy, his hemoglobin stabilized at around 8.5 g/dL and he did not require further transfusions. Outpatient hemodialysis was arranged, and he was discharged on hospital day 23.

One month after hospital discharge, the patient reported increasing lower abdominal pain at the dialysis unit. His hemoglobin was stable at 9.5 to 10.5 g/dL. A repeat non-contrast computed tomography abdomen and pelvis revealed interval enlargement of the left retroperitoneal hematoma, measuring up to 27×21×17 cm, concerning for ongoing bleeding. Following

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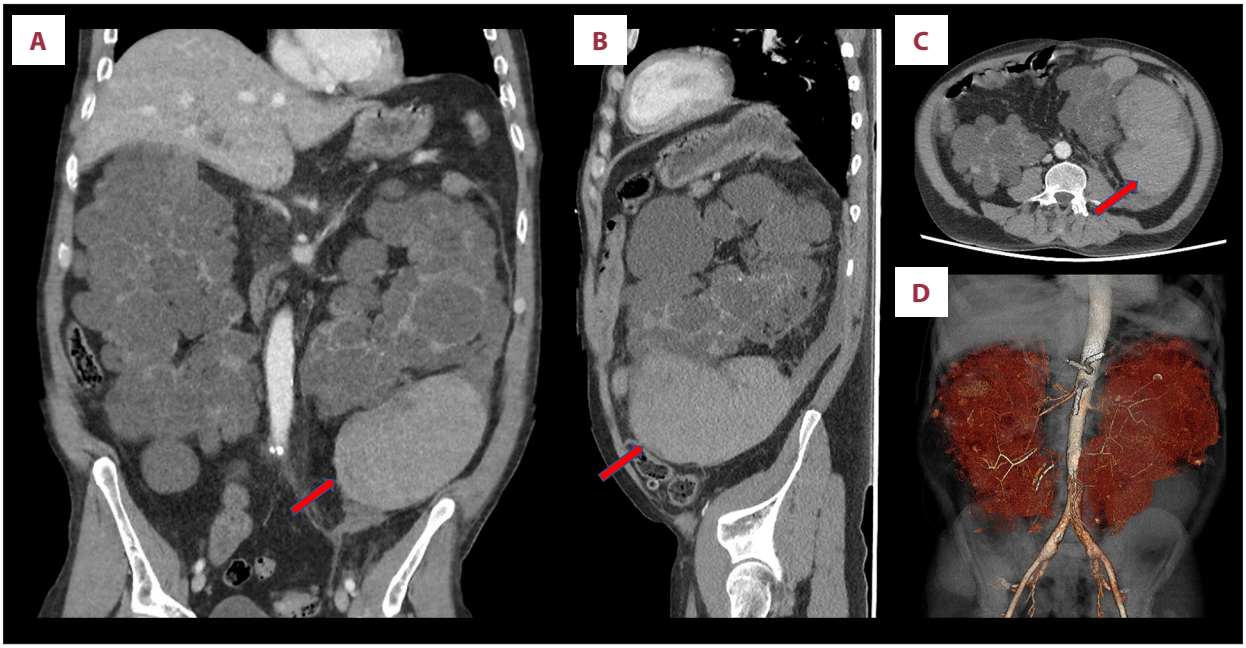

Figure 1. (**A-D**) Computed tomography (CT) angiogram of abdomen/pelvis demonstrating a large left retroperitoneal hematoma (arrows) in addition to bilaterally enlarged polycystic kidney consistent with the diagnosis of autosomal dominant polycystic kidney disease.

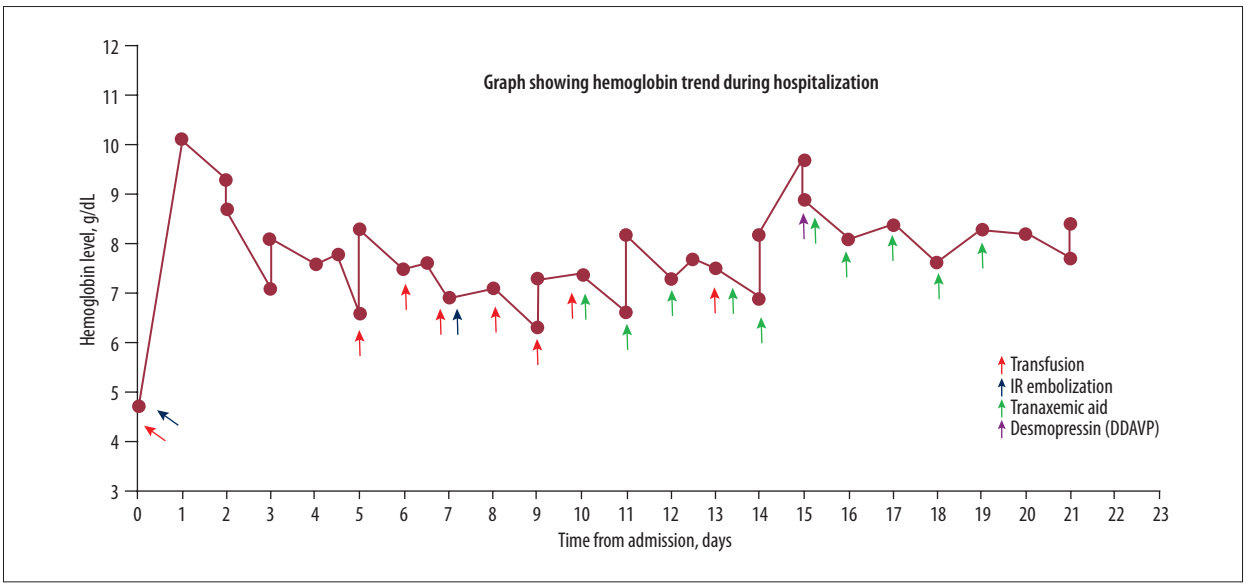

Figure 2. Graph showing the trend of hemoglobin over the hospitalization and interventions performed to manage cyst bleeding in our patient, including blood transfusions, interventional radiology-guided embolization, desmopressin, and tranexamic acid.

discussions with Interventional Radiology and Urology teams, conservative management was favored with close monitoring of blood counts and clinical status. He remained dialysis-dependent on 3-times-weekly incenter hemodialysis.

Genetic testing after hospital discharge demonstrated a pathogenic variant (c.165_171del) in the *PKD1* gene, confirming the diagnosis of ADPKD.

Discussion

Our case report aims to highlight the clinical presentation and management of massive cyst bleeding in autosomal dominant polycystic kidney disease (ADPKD). ADPKD is the most common monogenic cause of kidney failure, with an estimated worldwide incidence of about 12.5 million cases [1,2]. It is a systemic disorder characterized by relentless growth of numerous

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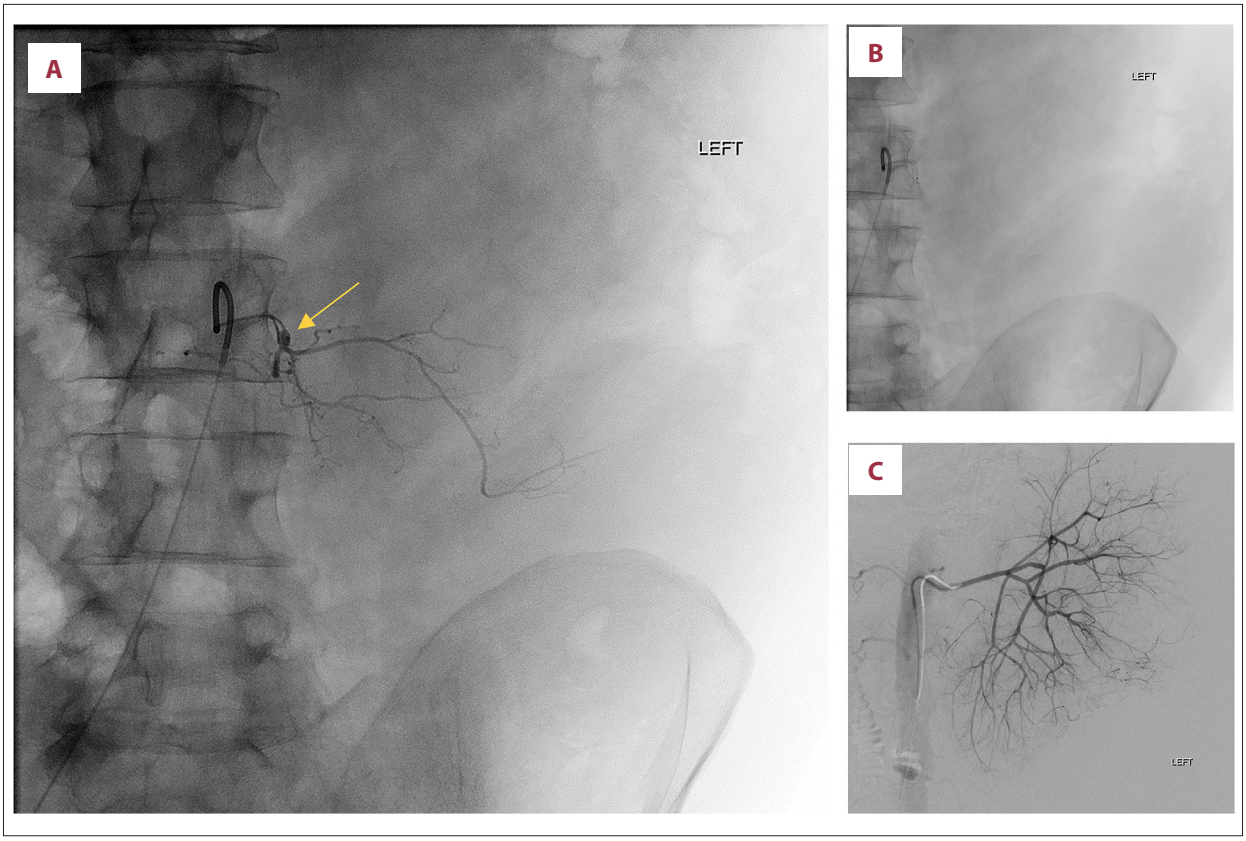

Figure 3. Selective left L3 lumbar arteriogram (**A**) demonstrating irregular vessels and a small focus of active bleeding (arrow). This left L3 lumbar artery was embolized to statis with Gelfoam, and subsequent injection showed no flow (**B**). The left renal artery angiogram showed an enlarged kidney with irregular vessels but no focus of active hemorrhage (**C**).

kidney cysts and resultant kidney enlargement, hypertension, destruction of kidney parenchyma, and loss of function [3-5]. ADPKD patients can be asymptomatic or may present with a variety of clinical manifestations. Abdominal fullness and pain, hypertension, proteinuria, and loss of glomerular filtration rate (GFR) are common presentations [3-5]. ADPKD can be associated with other complications, including gross hematuria and cyst hemorrhage, cyst infection, urinary tract infection, nephrolithiasis, urinary concentration defects, heart disease, liver cysts and hepatomegaly, and intracranial cysts [2-5].

In the United States, ADPKD has an estimated incidence of about 0.6 to 0.7 million cases [6]. In majority of the cases, ADPKD is associated with genetic pathogenic variants involving *PKD1* and *PKD2* genes, which encode polycystic-1 and 2 proteins, respectively [7]. Compared to *PKD2*, *PKD1* pathogenic variants are more common, and these patients often present with relatively more severe disease, higher total kidney volume (TKV), and earlier onset kidney failure (usually by the 5th or 6th decade of life) [4,6,7]. Our patient had imaging evidence of bilaterally enlarged kidneys with numerous renal cysts in each kidney, total kidney volume (TKV) of 5744 mL and positive genetic test with pathogenic variant in PKD1 gene, consistent with the diagnosis of ADPKD [6-9].

Cyst hemorrhage is a frequent complication seen in ADPKD patients [2-5]. Clinical presentation of cyst bleeding is usually relatively benign, with flank pain and tenderness, which subsides with conservative management involving bed rest, pain control, and hydration [6,10,11]. Rarely, patients present with severe persistent bleeding requiring hospitalization. Gross hematuria and/or passage of clots may be observed in the event of cyst rupture into the urinary collecting system, which often resolves within 1 week with conservative therapy [5]. If severe or persistent, cyst hemorrhage may be associated with a decline in kidney function [4,5].

Life-threatening spontaneous retroperitoneal hemorrhage following cyst rupture in the absence of major trauma or use of anti-coagulants, as seen in our patient, is a rare complication in ADPKD [4,5]. The precise incidence is unclear, as data are restricted to case reports [12-14]. With massive cyst bleeding, patients may present with signs and symptoms of hemorrhagic shock requiring prompt evaluation and management [3,5]. The diagnosis of retroperitoneal bleed can be confirmed with abdominal imaging using computed tomography (CT) angiography. Treatment often entails close observation in the Intensive Care Unit (ICU), routine monitoring of hemoglobin

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levels, resuscitation with blood products aiming for a hemoglobin of over 7 g/dL, and use of vasopressors as necessary following adequate resuscitation to maintain a mean arterial pressure of at least 65 mmHg. When conservative therapies fail and/or in the presence of active bleeding demonstrated on angiography, interventional radiology (IR)-guided percutaneous embolization is recommended [5,12,13]. In severe cases with refractory bleeding or failure of embolization, urgent nephrectomy may be indicated [13].

Our patient failed conventional treatment of persistent retroperitoneal hemorrhage. Despite undergoing percutaneous embolization twice, he continued to have evidence of ongoing bleeding. Tranexamic acid, a potent anti-fibrinolytic, was subsequently administered for 9 days. Tranexamic acid hinders fibrin degradation via reversible blockade of lysine binding sites on plasminogen molecules [15]. Use of tranexamic acid has been explored to control cyst bleeding in ADPKD patients [16,17]. It is hypothesized that tranexamic acid works by counteracting local and systemic activation of fibrinolysis by urokinase in ADPKD [17]. In a case reported by Sabovic et al, anti-fibrinolysis with tranexamic acid avoided nephrectomy in an ADPKD patient presenting with severe persistent gross hematuria [16]. In a case series, tranexamic acid was administered to 8 ADPKD patients presenting with gross hematuria unresponsive to conventional treatment. All patients had imaging evidence of intracystic bleeding. Bleeding was controlled within 2-5 days of treatment and no adverse effects of anti-fibrinolytic therapy were noted [17]. This case report highlights the complexity of retroperitoneal bleeding in patients with ADPKD following cyst rupture and the importance of arterial embolization, as well as consideration of oral tranexamic acid in this context.

Conclusions

This report highlights the diagnosis and management of cyst bleeding in ADPKD. Treatment of massive cyst bleeding involves resuscitation with blood products, management of shock, and interventional radiology-guided embolization [10-13]. Tranexamic acid may be considered in the appropriate clinical setting when conventional measures fail to mitigate cyst bleeding [16,17]. However, controlled clinical trials are necessary to better assess the role of anti-fibrinolytic therapy in cyst hemorrhage in ADPKD patients.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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