Siber Journal of Advanced Multidisciplinary (SJAM)
E-ISSN: 2987-1069
P-ISSN: 2987-1018
+62 822 1012 3600 https://research.e-siber.org siberpublisher.info@gmail.com

DOI: https://doi.org/10.38035/sjam.v3i1

Severe AV Shunt-Related Sepsis in a Chronic Dialysis Patient With Immobility and Protein Energy Wasting: A Case Report and Literature Review

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Abstract: Vascular access infections, particularly those involving arteriovenous (AV) shunts, are a major cause of morbidity and mortality in chronic hemodialysis patients, especially among those with prolonged access use, immunocompromise, and comorbidities such as malnutrition or immobility. Case Report: We describe a 62-year-old female with end-stage renal disease (ESRD) undergoing dual dialysis modalities (hemodialysis and CAPD), who developed sepsis secondary to an infected left brachial AV shunt. Her condition was further complicated by three years of immobilization due to untreated bilateral femoral fractures and severe protein-energy wasting (PEW). Discussion: This case illustrates the diagnostic and therapeutic challenges of sepsis in dialysis patients, including atypical clinical presentation, altered inflammatory markers, and the complexity of antibiotic management in the setting of renal failure. Furthermore, it underscores how overlapping clinical issues such as infection risk, poor nutritional status, and physical dependency necessitate an integrated approach to care. Conclusion: Early recognition of AV shunt infections and prompt intervention are critical to preventing systemic complications. Comprehensive multidisciplinary collaboration is essential for improving outcomes in ESRD patients with complex comorbidities, emphasizing infection control, nutritional rehabilitation, mobility support, and individualized dialysis planning.

Keyword: AV Shunt Infection, Sepsis, End-Stage Renal Disease, Dual Dialysis, Protein-Energy Wasting, Immobilization, Multidisciplinary Care, Chronic Kidney Disease, Hemodialysis, CAPD

INTRODUCTION

Vascular access-related infections remain a significant cause of morbidity and mortality among patients undergoing maintenance hemodialysis. Arteriovenous (AV) shunts, while essential for long-term dialysis access, carry a notable risk for local and systemic infections, particularly in elderly and immunocompromised patients. When these infections progress unchecked, they can lead to sepsis, shock, and multi-organ dysfunction, with mortality rates reported to be as high as 20–30% in such populations. Early recognition and aggressive management are therefore critical to improve patient outcomes. (1)

In parallel, the coexistence of Continuous Ambulatory Peritoneal Dialysis (CAPD) and Hemodialysis (HD) in a single patient is uncommon and usually reflects either transition phases or complex clinical challenges, such as peritonitis, volume overload, or access failure. Patients on dual modalities often face compounded risks of infection, electrolyte imbalances, and nutritional deterioration. Moreover, when mobility is compromised such as in cases of prolonged immobilization due to untreated femoral fractures the risk of Protein Energy Wasting (PEW), venous thromboembolism (VTE), and further clinical decline increases significantl. (2) (3)

This case presents a unique combination of AV shunt-associated abscess leading to sepsis in a 62-year-old female on both HD and CAPD, compounded by three years of immobilization, untreated bilateral femoral fractures, and evidence of PEW. The complexity of her case reflects the intersection of vascular access management, dialysis strategy optimization, infection control, and nutritional rehabilitation. It highlights the urgent need for multidisciplinary care models in managing high-risk chronic kidney disease (CKD) patients with multiple disabilities.

Case Report

A 62-year-old Balinese woman, Hindu, married, and fully dependent on family caregivers, was admitted to Central General Hospital due to complaints of fever and progressive weakness over the past week. The patient also reported purulent lesions on her left arm, particularly around the brachial and antebrachial regions, which had been present for nearly two weeks. These lesions worsened approximately four days prior to admission, coinciding with the use of the affected arm as an access site for hemodialysis through a left-sided arteriovenous (AV) shunt. She noted the development of blisters and purulent discharge at the site, accompanied by localized pain, swelling, and persistent fever unresponsive to antipyretic therapy.

In addition to the febrile symptoms, the patient complained of a non-productive cough starting on the morning of admission, but denied experiencing any shortness of breath. She also reported anuria and marked fatigue. Her mobility was severely impaired; she had been completely immobilized for the past three years following a left intertrochanteric femur fracture. She also mentioned a previous fracture in the right femur that had not been surgically corrected. Over this period, the patient experienced significant weight loss and muscle wasting in her extremities.

Her past medical history was notable for hypertension and hyperuricemia for more than ten years, as well as chronic kidney disease (CKD) stage V. She had been on regular hemodialysis through an AV shunt since 2010, and additionally had been maintained on Continuous Ambulatory Peritoneal Dialysis (CAPD) since 2012. Her daily medications included carvedilol, valsartan, febuxostat, and folic acid.

On physical examination, the patient appeared moderately ill, with initial hypotension (blood pressure 80/60 mmHg), tachycardia (111 bpm), and a body temperature of 37.8°C. The left arm showed clear signs of local infection, including erythema, edema, and purulent discharge around the AV shunt site. Lung auscultation revealed normal vesicular breath sounds without rales or wheezes, while cardiovascular examination noted a regular rhythm with a soft systolic murmur. The abdomen was non-distended, with normal bowel sounds and no hepatosplenomegaly. Extremities were warm, with no significant edema. Neurologically, her Glasgow Coma Scale (GCS) score was 15.

Initial laboratory work-up revealed normocytic normochromic anemia with a hemoglobin level of 9.5 g/dL, consistent with anemia of chronic disease. The white blood cell count was elevated at 13,000/mm³, indicating an ongoing infectious process, while platelet levels remained within normal limits at 220,000/mm³. Renal function tests showed markedly elevated blood urea nitrogen (BUN) at 65 mg/dL and serum creatinine at 13.4 mg/dL,

consistent with end-stage renal disease. Electrolyte evaluation revealed hypokalemia with a serum potassium level of 2.8 mmol/L. The patient also demonstrated hypoalbuminemia (albumin 2.7 g/dL), likely reflecting protein-energy wasting and chronic illness. Inflammatory markers, including C-reactive protein (CRP) and procalcitonin, were elevated, supporting a diagnosis of systemic infection. Coagulation parameters and random blood glucose were within normal limits.

An electrocardiogram (ECG) performed on admission showed normal sinus rhythm with a heart rate of 100 beats per minute, normal PR interval, and features suggestive of left ventricular hypertrophy (V1 + V5/6 > 35 mm). A chest radiograph taken in an anteroposterior (AP) projection revealed multiple osteophytes in the thoracic vertebrae, a normal cardiac silhouette with a cardiothoracic ratio of 52%, and aortic calcification suggestive of atherosclerosis. There was widening of the superior mediastinum and thickening of the right hilum, raising suspicion of chronic pulmonary changes. Notably, multiple cavitary lesions were observed in the middle zone of the right lung, warranting further investigation for possible infectious or post-infectious etiologies. The trachea was midline, and no pleural effusion or active consolidation was noted.

The initial management focused on stabilizing the patient's hemodynamic status and addressing the suspected septic source. Intravenous fluid resuscitation with isotonic saline was administered, beginning with a 250 mL bolus titrated to achieve a mean arterial pressure above 65 mmHg, followed by maintenance fluids at 500 mL per 24 hours. Hypokalemia was corrected with a slow infusion of 25 mEq potassium chloride diluted in 500 mL of normal saline, administered at a rate of 8 drops per minute. Empirical broad-spectrum antibiotics were initiated, including intravenous ceftriaxone 2 grams once daily and metronidazole 500 mg every eight hours, targeting both gram-positive, gram-negative, and anaerobic pathogens pending culture results. Additional supportive therapies included oral paracetamol 650 mg every eight hours for fever, and N-acetylcysteine 200 mg every eight hours to support mucolysis and antioxidant function. Antihypertensive medications were temporarily withheld due to initial hypotension.

Renal replacement therapy was continued through both modalities CAPD four times daily and intermittent hemodialysis (3.5-hour session with minimal heparin) through the existing AV shunt. A CKD-adapted nutritional regimen was prescribed, consisting of 1500 kcal per day and 1.3 grams of protein per kilogram body weight (~66.8 grams/day), with high potassium intake to address ongoing hypokalemia. The clinical team planned serial monitoring of fluid status, serum potassium levels, and vital signs, as well as wound and blood cultures to guide targeted antimicrobial therapy. Referral to a clinical nutritionist was arranged to optimize nutritional intake, and further orthopedic and rehabilitative evaluation was considered due to the patient's longstanding immobilization and uncorrected femoral fractures.

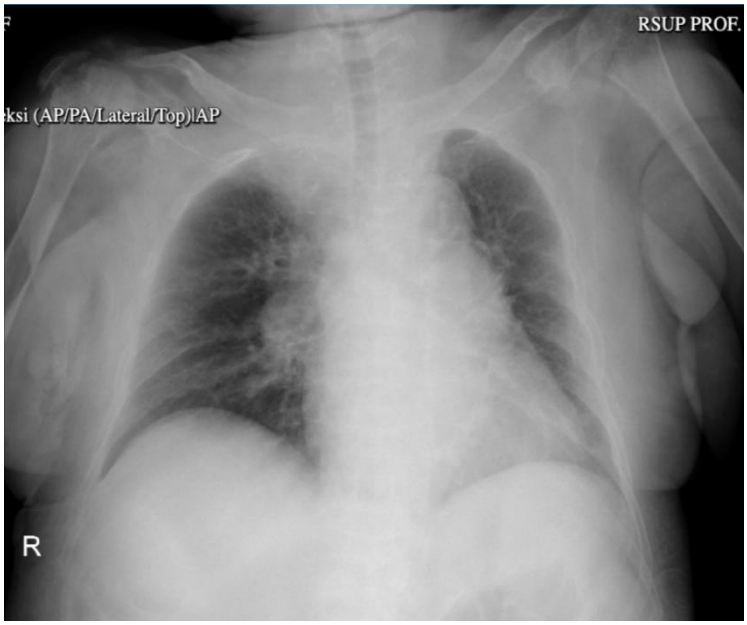

Figure 1. Chest X Ray of The Patient Kardiomegali

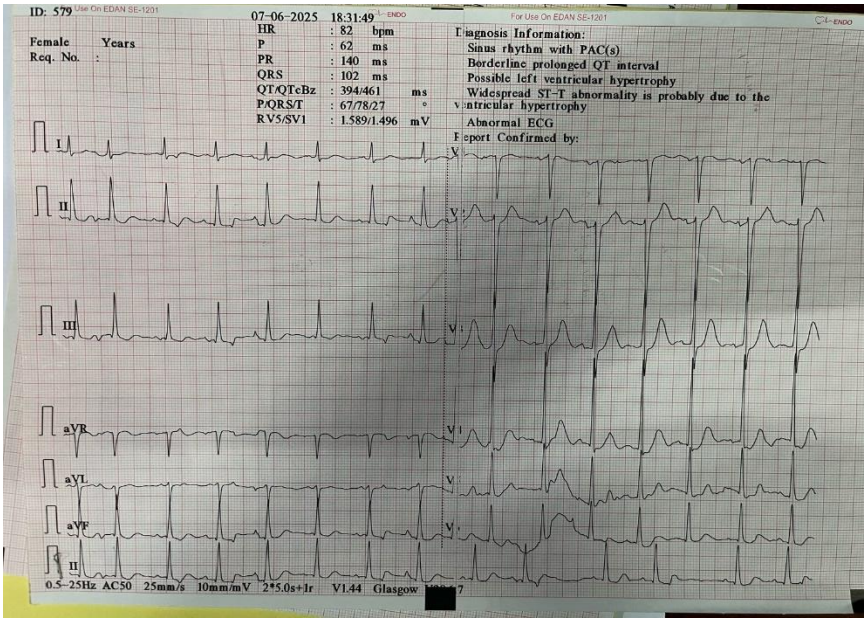

Figure 2. ECG of The Patient Sinus Tachycardia

Figure 3. Site Infection of AV Shunt and Fracture of the Right Leg

Figure 4. CAPD patient and there is no sign of infection

METHOD

In cases of total dependency or progressive disability, such as the one presented, the involvement of a palliative care team or chronic care unit may become essential. These teams are instrumental in aligning medical interventions with the patient's goals of care, especially when curative or rehabilitative options are limited. Palliative nephrology is an emerging field that emphasizes symptom control, psychosocial support, and end-of-life planning in ESRD patients who face repeated hospitalizations and declining function. In this patient's case, a chronic care model could have facilitated consistent access management, nutritional maintenance, psychosocial support, and home-based rehabilitation, thereby improving comfort and reducing unnecessary admissions.(14)

RESULTS AND DISCUSSION

Vascular access remains the lifeline for patients undergoing maintenance hemodialysis, and among the available modalities, arteriovenous (AV) shunts are considered more durable and preferred over central venous catheters due to their lower long-term infection risk. However, despite this relative advantage, AV shunts are not immune to infectious complications. Infections of the AV access site are a major cause of morbidity in hemodialysis patients, with studies showing that vascular access infections account for up to 20% of all hospitalizations among dialysis patients. These infections are particularly dangerous in elderly and immunocompromised individuals, such as those with end-stage renal disease (ESRD), due to impaired immune responses, poor wound healing, and frequent access manipulations. (4)

In the present case, the patient developed local signs of infection including erythema, edema, and purulent discharge at the left brachial AV shunt site, which served as the point of entry for hemodialysis. The progression of this local infection into systemic sepsis underscores the high risk associated with AV access site contamination, especially in patients with prolonged access usage. Notably, this patient had been on regular hemodialysis since 2010, a duration that significantly increases the cumulative risk of infection due to repeated cannulation and biofilm formation. Early identification of AV shunt-related infections is critical because delayed recognition can lead to rapid deterioration, including hypotension and septic shock, as observed in this case. (5)

The type of vascular access used in dialysis plays a significant role in the incidence and severity of infectious complications. According to the U.S. Centers for Disease Control and Prevention (CDC) and the Dialysis Outcomes and Practice Patterns Study (DOPPS), central venous catheters (CVCs) carry the highest infection risk, followed by AV grafts (shunts), and then AV fistulas, which are considered the safest option in terms of infection rate. AV shunts, particularly those made from synthetic materials or used for extended periods, are more prone to colonization by skin flora such as *Staphylococcus aureus* and *coagulase-negative staphylococci*, both of which are common culprits in bloodstream infections among hemodialysis patients. (6)

The patient's dual modality of dialysis combining CAPD with intermittent hemodialysis may also have contributed to the heightened infection risk. Although the rationale for combining modalities may include inadequate ultrafiltration or fluid overload, this approach entails more frequent access manipulations, thereby increasing the exposure to pathogens. Furthermore, this patient's prolonged immobilization, hypoalbuminemia, and evidence of protein-energy wasting likely compromised her immune defenses, making her more vulnerable to AV shunt infection and its progression to systemic sepsis. This case illustrates the critical need for vigilant AV site care, regular surveillance for infection signs, and timely intervention in patients with long-term access use and high-risk clinical profiles.

Diagnosing sepsis in patients with end-stage renal disease (ESRD) presents a unique set of challenges due to atypical clinical manifestations and altered physiological responses. Unlike the general population, ESRD patients may not exhibit classic signs of sepsis such as high-grade fever, leukocytosis, or hypotension, due to impaired immune function and chronic inflammation. In some cases, symptoms like altered mental status, mild hypothermia, or hemodynamic instability may be the only indicators of an ongoing systemic infection. In the current case, although the patient developed fever and hypotension, the presentation remained subacute and could have been easily overlooked without thorough evaluation of the AV shunt site, which served as the infectious focus. (7)

Inflammatory biomarkers, while routinely used in sepsis diagnosis, also pose interpretation challenges in the CKD population. For example, C-reactive protein (CRP) and

procalcitonin (PCT) are often elevated in ESRD patients even in the absence of active infection, due to the baseline pro-inflammatory state associated with uremia and dialysis-related oxidative stress. This baseline elevation can blunt the diagnostic value of these markers unless interpreted in the context of clinical deterioration, such as new-onset hypotension or progressive leukocytosis. In this case, elevated CRP and PCT levels aligned with worsening clinical signs, reinforcing the likelihood of systemic infection. It is critical to track the *trend* of these biomarkers rather than relying solely on absolute values in this population. (8)(9)

Empirical antimicrobial therapy in ESRD patients with suspected sepsis must be both prompt and judicious. Due to altered pharmacokinetics and reduced renal clearance, many antibiotics require dose adjustments to avoid toxicity while maintaining efficacy. Furthermore, broad-spectrum coverage is generally indicated initially especially when the source is vascular access until culture results are available. In this patient, the combination of ceftriaxone and metronidazole was selected to cover both gram-negative bacilli and anaerobic organisms, a reasonable choice given the presence of purulent drainage at the AV site and the risk of skin and soft tissue pathogens like *Staphylococcus aureus* and *Pseudomonas aeruginosa*. The dual dialysis modalities (HD and CAPD) further complicated the pharmacological landscape, necessitating close coordination with nephrology for antibiotic timing and dosing. (10)

Beyond initial empiric therapy, the management of sepsis in dialysis patients must include ongoing fluid balance monitoring, electrolyte correction, and source control. Unlike in non-CKD patients, aggressive fluid resuscitation in ESRD individuals may lead to volume overload and pulmonary edema. Therefore, fluid administration must be cautiously titrated, often requiring support from ultrafiltration during hemodialysis. In the current case, the patient was managed with conservative intravenous fluids alongside dialysis and potassium repletion for hypokalemia, highlighting the delicate balance needed in ESRD sepsis care. Blood and wound cultures were drawn to de-escalate antibiotics once the causative organism was identified, in alignment with antimicrobial stewardship principles.

The management of patients with end-stage renal disease (ESRD), particularly those with multiple comorbidities and functional disabilities, requires an integrated, multidisciplinary approach. In the case presented, the patient faced not only chronic kidney failure managed through dual dialysis modalities but also sepsis, severe protein-energy wasting, and prolonged immobilization due to neglected bilateral femoral fractures. These intersecting clinical issues necessitate close collaboration between nephrologists, infectious disease specialists, nutritionists, medical rehabilitation teams, and orthopedic surgeons. Such coordination ensures that the infection source is controlled, nutritional status is optimized, physical function is gradually restored, and renal replacement therapy is safely continued. (11)

Multidisciplinary care has been associated with improved patient outcomes in ESRD, particularly in reducing hospital readmissions, enhancing nutritional recovery, and preventing dialysis-related complications. For example, timely involvement of clinical nutritionists in CKD care has shown to improve serum albumin levels and reduce inflammation, while early rehabilitation interventions can mitigate muscle wasting and enhance quality of life. In this case, involving an orthopedic team could have addressed the neglected femoral fractures earlier, potentially preventing long-term immobility and its consequences. Unfortunately, the lack of early surgical correction likely contributed to the patient's frailty and dependency, illustrating how delays in multidisciplinary collaboration can negatively affect prognosis. (12)

Moreover, chronic infection and sepsis in dialysis patients often require individualized antibiotic strategies that must be tailored in consultation with infectious

disease experts, especially due to altered pharmacokinetics in renal failure and dialysis schedules. Simultaneously, rehabilitation services play a key role in maintaining or recovering physical function, particularly in patients with fractures or prolonged bed rest. Even modest gains in mobility can significantly reduce the risk of venous thromboembolism, improve circulation, and enhance the patient's ability to participate in their own care. In this context, interdisciplinary communication must be continuous and patient-centered, with shared goals across specialties.（13)

In cases of total dependency or progressive disability, such as the one presented, the involvement of a palliative care team or chronic care unit may become essential. These teams are instrumental in aligning medical interventions with the patient’s goals of care, especially when curative or rehabilitative options are limited. Palliative nephrology is an emerging field that emphasizes symptom control, psychosocial support, and end-of-life planning in ESRD patients who face repeated hospitalizations and declining function. In this patient's case, a chronic care model could have facilitated consistent access management, nutritional maintenance, psychosocial support, and home-based rehabilitation, thereby improving comfort and reducing unnecessary admissions. (14)

CONCLUSION

This case underscores the critical risks associated with long-term vascular access in hemodialysis patients, particularly when compounded by dual dialysis modalities, immobility, and malnutrition. The development of severe AV shunt-related sepsis in a patient with end-stage renal disease and multiple comorbidities highlights the importance of vigilant infection control, early sepsis recognition, and tailored antibiotic therapy. Moreover, the case illustrates the necessity of a multidisciplinary approach including nephrology, infectious diseases, nutrition, rehabilitation, and palliative care to address complex clinical needs, improve outcomes, and preserve quality of life in vulnerable dialysis populations.

REFERENSI

Allon M. Lessons From International Differences in Vascular Access Practices and Outcomes. American Journal of Kidney Diseases. 2018 Apr;71(4):452–4.

Carrero JJ, Stenvinkel P, Cuppari L, Ikizler TA, Kalantar-Zadeh K, Kaysen G, et al. Etiology of the Protein-Energy Wasting Syndrome in Chronic Kidney Disease: A Consensus Statement From the International Society of Renal Nutrition and Metabolism (ISRNM). Journal of Renal Nutrition. 2013 Mar;23(2):77–90.

Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. The Lancet. 2013 Mar;381(9868):752–62.

Germain M, Cohen LM. Renal Supportive Care: View from Across the Pond: The United States Perspective. Journal of Palliative Medicine. 2007 Dec;10(6):1241–4.

Kalantar-Zadeh K, Ikizler TA, Block G, Avram MM, Kopple JD. Malnutrition-inflammation complex syndrome in dialysis patients: causes and consequences. American Journal of Kidney Diseases. 2003 Nov;42(5):864–81.

Koplan JP. Recommendations for Preventing Transmission of Infections Among Chronic Hemodialysis Patients. US Departement Health and Human Service. 2001;50(1):1–40.

Lok CE, Mokrzycki MH. Prevention and management of catheter-related infection in hemodialysis patients. Kidney International. 2011 Mar;79(6):587–98.

Mallamaci F, Pisano A, Tripepi G. Physical activity in chronic kidney disease and the EXerCise Introduction To Enhance trial. Nephrology Dialysis Transplantation. 2020 Mar 1;35(Supplement_2):ii18–22.

Massaro KS, Costa SF, Leone C, Chamone DA. Procalcitonin (PCT) and C-reactive Protein (CRP) as severe systemic infection markers in febrile neutropenic adults. BMC Infect Dis. 2007 Dec;7(1):137.

Panichi V, Maggiore U, Taccola D, Migliori M, Rizza GM, Consani C, et al. Interleukin-6 is a stronger predictor of total and cardiovascular mortality than C-reactive protein in haemodialysis patients. Nephrology Dialysis Transplantation. 2004 May 1;19(5):1154–60.

Pisoni RL, Zepel L, Port FK, Robinson BM. Trends in US Vascular Access Use, Patient Preferences, and Related Practices: An Update From the US DOPPS Practice Monitor With International Comparisons. American Journal of Kidney Diseases. 2015 Jun;65(6):905–

Rekik S, Trabelsi I, Hentati M, Hammami A, Jemaa MB, Hachicha J, et al. Infective endocarditis in hemodialysis patients: clinical features, echocardiographic data and outcome: A 10-year descriptive analysis. Clin Exp Nephrol. 2009 Aug;13(4):350–4.

Sarnak MJ, Jaber BL. Mortality caused by sepsis in patients with end-stage renal disease compared with the general population. Kidney International. 2000;58(1):1758–64.

Wang SM, Hsiao LC, Ting IW, Yu TM, Liang CC, Kuo HL, et al. Multidisciplinary care in patients with chronic kidney disease: A systematic review and meta-analysis. European Journal of Internal Medicine. 2015 Oct;26(8):640–5.