Nigerian Medical Journal
NIGERIA MEDICAL ASSOCIATION
Print ISSN 0300-1652, E-ISSN 2229-774X

Case Report

The Yellow Dialyzer Sign: An Unassuming Indicator of Occult Jaundice in Patients with End-stage Kidney Disease. A Case Report

Chimezie Godswill Okwuonu[1], Rasheed Abiodun Balogun[2,3*]

[1]Department of Internal Medicine, Federal Medical Centre, Umuahia, Abia State, Nigeria, [2]Division of Nephrology and Center for Immunity, Inflammation and Regenerative Medicine, University of Virginia, Charlottesville, Virginia, USA, [3]Department of Pathology, University of Virginia, Charlottesville, Virginia, USA

Abstract

In patients with end-stage renal disease (ESRD), diagnosing jaundice can be challenging because uremic skin changes and anuria may obscure classic signs such as scleral icterus and dark urine. We report a rare case in which discoloration of the hemodialysis circuit provided the first clue to occult hyperbilirubinemia. A 35-year-old woman with ESRD secondary to lupus nephritis presented for hemodialysis with features of uremia and fluid overload. Physical examination revealed no scleral icterus or skin discoloration. After a 2-hour session using a low-flux polysulfone dialyzer, a striking yellowish discoloration of the dialyzer membrane was noted. Laboratory evaluation, prompted by this observation, revealed marked unconjugated hyperbilirubinemia, elevated lactate dehydrogenase, low haptoglobin, and hemoglobinuria, confirming intravascular hemolysis complicating systemic lupus erythematosus. The yellow discoloration was attributed to the adsorption of bilirubin-albumin complexes onto the hollow fibers of the dialyzer membrane. The patient was treated with high-dose oral prednisolone for autoimmune hemolytic anemia associated with a lupus flare. Over three weeks and six subsequent dialysis sessions, hemolysis markers normalized, the yellow discoloration resolved, and her clinical condition improved significantly. Yellowish staining of the dialyzer membrane is an uncommon but important bedside sign of hyperbilirubinemia in patients undergoing dialysis. This extracorporeal indicator may reveal serious conditions such as intravascular hemolysis or hepatic dysfunction when conventional clinical signs are absent. Careful inspection of the dialysis circuit can facilitate early diagnosis, prompt treatment, and improved outcomes in this vulnerable population.

Keywords: Hyperbilirubinemia; Jaundice; Dialyzer discoloration; Yellow dialyzer; Lupus nephritis; Bilirubin

***Correspondence** Prof. Rasheed Abiodun Balogun, Division of Nephrology and Center for Immunity, Inflammation and Regenerative Medicine, University of Virginia Health, Charlottesville, Virginia, USA, Email: rb8mh@uvahealth.org

How to Cite: Okwuonu CG, Balogun RA. The yellow dialyzer sign: an unassuming indicator of occult jaundice in patients with end-stage kidney disease. A case report. Niger Med J 2026; 67 (1): 2874-2880. https://doi.org/10.71480/nmj.v67i1.1243

Quick Response Code:

Introduction

Yellowish discoloration of a dialyzer during or after dialysis is a significant clinical finding that typically indicates severe hyperbilirubinemia (jaundice) or the presence of certain drugs or dyes in the patient's bloodstream [1]. It is a rare but important visual clue, particularly in anuric patients where jaundice might be masked. The primary clinical implication is the need for prompt investigation into the underlying cause of the discoloration, as it often points to serious underlying medical conditions or drug reactions requiring immediate attention.

Bilirubin is a yellow pigment produced during the normal breakdown of red blood cells [2]. It is typically processed by the liver and excreted in bile, and in healthy individuals, serum bilirubin levels are low [3]. In patients with severe hyperbilirubinemia (typically when total bilirubin exceeds 3 mg/dL), bilirubin-albumin complexes cannot pass through the pores of standard dialysis membranes effectively due to their large molecular size and low water solubility. Instead, they become entrapped in the dialyzer's hollow fibers by adsorption, staining the membrane yellow [4].

There are a few reported cases of dialyzer discoloration during and after hemodialysis [1,4]. In these case reports, the yellowish discoloration of the dialyzer prompted investigation for hyperbilirubinemia, which was subsequently confirmed.

We hereby present a case of a patient with end-stage renal disease on maintenance hemodialysis who was found to have yellowish discoloration of the dialyzer membrane. Our aim is to remind physicians and nurses involved in dialysis therapy that close attention to the dialyzer's color is a simple yet effective observation that aids in the comprehensive care and diagnosis of patients undergoing dialysis.

Case Report

Patient Information

A 35-year-old woman with end-stage renal disease (ESRD) secondary to lupus nephritis presented for her first session of maintenance hemodialysis. Her primary complaints were consistent with advanced uremia and fluid overload: bilateral leg swelling, persistent vomiting, hiccups, and anorexia. The patient denied pruritus, and there was no history of acholic (pale) stools.

Clinical Findings

On physical examination, the patient appeared uremic but was anicteric. The sclerae were white, and there was no evidence of jaundice on the palms or skin. Significant findings included pallor of the conjunctiva and skin creases, alongside bilateral pitting edema to the mid-leg. Vital signs were stable, and other systemic examinations were unremarkable.

Timeline and Diagnostic Assessment

Initial laboratory results confirmed ESRD with profound uremia and hyperkalemia. Viral screenings for hepatitis B, hepatitis C, and HIV were negative (Table 1).

The first hemodialysis session was initiated with blood flow ≤250 mL/min, 2-hour duration, using a low-flux FX8 Fresenius polysulfone dialyzer. While the patient remained stable during the procedure, a prominent yellowish discoloration of the dialyzer membrane was observed post-treatment.

Following this visual cue, targeted investigations were performed (Table 2):

Total bilirubin was significantly elevated, with a predominantly unconjugated fraction. Hemolysis markers included low haptoglobin, elevated lactate dehydrogenase (LDH), and positive hemoglobinuria. Lupus activity indices, including anti-double-stranded DNA (dsDNA) antibodies and anti-nuclear antibodies (ANA), were markedly deranged (Table 1); complement levels were not assessed.

The diagnosis was intravascular hemolytic anemia complicating an acute flare of systemic lupus erythematosus (SLE).

Figure 1: Yellowish discoloration of the dialyzer membrane at the first session of dialysis (a) and after two weeks of treatment (b).

(a) *(b)*

Therapeutic Intervention and Outcomes

The patient was started on high-dose oral prednisolone, which was gradually tapered. She underwent six additional dialysis sessions over three weeks. Yellow staining of the dialyzer was observed during the second and subsequent hemodialysis sessions, but with progressively reduced intensity. By the end of the sixth session (second week of treatment), the yellow staining was no longer observed. Follow-up laboratory investigations showed marked improvement in kidney function parameters, ANA, anti-dsDNA (Table 1), normalized bilirubin, LDH, and haptoglobin levels, alongside an improved erythrocyte sedimentation rate (ESR) and hemoglobin concentration (Table 2).

Table 1: Results of selected laboratory investigations showing uraemia and anaemia at the start of treatment and improvement at two weeks

Parameter	At initiation of treatment	Second week on treatment	Normal range
Serum Creatinine (µmol/L)	1,132	356	45–110
Serum Urea (mg/dL)	243	63	10–50
Serum Potassium (mmol/L)	5.6	3.8	3.5–5.0
Serum Bicarbonate (mmol/L)	13	29	22–29
White Blood Cell Count ($\times 10^9$/L)	5	10	4–11
Haemoglobin (g/dL)	8	12.5	13.5–17.5
Platelets ($\times 10^9$/L)	253	249	150–450
Erythrocyte Sedimentation Rate (mm/hour)	75	18	0–15
Hepatitis B surface antigen	Non-reactive	—	Non-reactive
Hepatitis C antibody	Non-reactive	—	Non-reactive
HIV screening	Non-reactive	—	Non-reactive
Anti-nuclear antibodies (IU/mL)	7.8	2.4	<1.0
Anti-double-stranded DNA (IU/mL)	33	8.5	10–25

Table 2: Post-dialysis laboratory results showing liver enzymes, bilirubin, lactate dehydrogenase, haptoglobin, and serum albumin at the start of treatment and at two weeks

Parameter	At start of treatment	Second week on treatment	Normal range
Alanine aminotransferase (U/L)	21	20	7–55
Aspartate aminotransferase (U/L)	25	28	8–48
Alkaline phosphatase (U/L)	33	26	40–129

Total bilirubin (mg/dL)	12	0.9	0.2–1.2
Unconjugated bilirubin (mg/dL)	11	0.7	0.2–0.8
Conjugated bilirubin (mg/dL)	0.3	0.2	0.1–0.3
Lactate dehydrogenase (U/L)	359	124	100–280
Haptoglobin (mg/dL)	11	78	30–200
Serum albumin (g/dL)	4.5	4.9	3.5–5.5

Ethical Consideration

The patient provided written informed consent for the publication of this case report, including all associated images and clinical data. The patient was informed that their name and initials will not be published and that efforts will be made to conceal their identity, although total anonymity cannot be guaranteed.

Discussion

The principal finding of this case report is the unexpected observation of prominent yellowish discoloration of the dialyzer membrane during hemodialysis, which served as an early and objective indicator of severe, yet clinically unapparent, hyperbilirubinemia in a patient with ESRD. In patients with chronic kidney disease and uremia, the typical clinical signs of jaundice, such as scleral icterus and dark urine, are often masked by factors including skin pigmentation and anuria, making diagnosis challenging through routine physical examination alone.

In the bloodstream, bilirubin is primarily bound to albumin, making the complex large and poorly water-soluble [5]. Traditional dialysis membranes are designed to remove small, water-soluble waste products such as urea and creatinine via diffusion [6,7]. Because bilirubin-albumin complexes are too large to cross the dialysis membrane effectively, they accumulate within the hollow fibers by adsorption, staining the membrane yellow [8]. This yellow discoloration serves as a visual clue for clinicians, indicating hemolysis, hepatic dysfunction, or an adverse drug reaction. In anuric uremic patients, tea-colored urine — another classic jaundice sign — is absent, making dialyzer discoloration a critical diagnostic indicator. Other causes of yellowish discoloration, such as fluorescein dye and drug-induced hyperbilirubinemia (e.g., rifampicin, propofol, fruquintinib), were excluded because the patient did not undergo diagnostic eye testing and had no relevant drug history [1].

Our patient shares a comparable clinical profile with the case reported by Chiew et al. of a 43-year-old Chinese man with chronic viral hepatitis and ESRD, in whom yellowish discoloration of the hollow fibers of the dialyzer was documented after dialysis [1]. Biochemistry confirmed hyperbilirubinemia with a serum bilirubin of 7.4 mg/dL. As in our patient, there was no clinical symptom of pruritus or icterus.

Similarly, Parikh et al. reported a 65-year-old African-American man with ESRD secondary to hypertension and diabetes mellitus who was noted to have a yellow dialyzer post-hemodialysis [4]. His only complaint was severe pruritus for two days. On examination, he had no scleral or palatal icterus; however, laboratory testing revealed a total bilirubin of 13.1 mg/dL with a direct bilirubin of >10.0 mg/dL, indicating hepatic dysfunction.

The pattern of hyperbilirubinemia in our patient is consistent with intravascular hemolysis, characterized by unconjugated hyperbilirubinemia, low haptoglobin, elevated LDH, and hemoglobinuria, without evidence of hepatic dysfunction. The onset of hemolytic anemia in a patient with lupus nephritis indicates a more severe and aggressive form of SLE, which is associated with poor clinical outcomes, higher risk of organ damage, and increased mortality [9-12]. Prompt investigation and treatment with corticosteroids, made possible by recognition of the dialyzer discoloration, contributed to the favorable outcome in this patient. Without this visual cue, the occult hyperbilirubinemia may have gone undetected, delaying treatment and potentially worsening outcomes.

Limitation

There is no standardized correlation between the intensity of the yellow hue and specific serum bilirubin levels. Bilirubin removal rates vary based on dialysis flow rates and membrane types, making it difficult to estimate the severity of jaundice by sight. We also acknowledge that yellowish discoloration is not pathognomonic for jaundice, as it can also result from certain medications (e.g., rifampicin, propofol, or fruquintinib) or exposure to dyes such as fluorescein; none of which applied to this patient. Despite these limitations, the principal strength of this case report lies in the improved treatment outcome achieved through unmasking of hemolytic anemia and associated unconjugated hyperbilirubinemia caused by SLE — made possible through vigilance in observing dialyzer color during hemodialysis.

Conclusion

Yellowish discoloration of the dialyzer is a rare but vital clinical indicator of hyperbilirubinemia, particularly in patients where uremic skin changes and anuria mask traditional manifestations of jaundice. Timely recognition should trigger immediate diagnostic workup, including total and direct bilirubin, liver function tests, and a complete blood count with hemolysis markers, to improve patient outcomes and identify potentially life-threatening conditions. This case underscores the importance of vigilant observation by the dialysis team, as the dialyzer may serve as the sole early warning for occult hyperbilirubinemia or hepatobiliary disease.

References

[1] Chiew YW, Peng SJ, Yang CS. Yellowish discoloration of dialyzer. Hemodial Int. 2012;16(3):444-6.

[2] Kalakonda A, Jenkins BA, John S. Physiology, Bilirubin. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025.

[3] Hansen TWR, Wong RJ, Stevenson DK. Molecular Physiology and Pathophysiology of Bilirubin Handling by the Blood, Liver, Intestine, and Brain in the Newborn. Physiol Rev. 2020;100(3):1291-1346.

[4] Parikh R, Andrade Paz H, Uppal NN, Sachdeva M. A case of a yellow dialyzer in a hemodialysis patient. Abstract PO1196. American Society of Nephrology Annual Meeting; 2020.

[5] Sticova E, Jirsa M. New insights in bilirubin metabolism and their clinical implications. World J Gastroenterol. 2013;19(38):6398-407.

[6] Dialysis, principles and treatment. The Pharmaceutical Journal. March 2015. Available at: https://pharmaceutical-journal.com/article/ld/dialysis-principles-and-treatment-options. Accessed December 23, 2025.

[7] InformedHealth.org [Internet]. Cologne, Germany: Institute for Quality and Efficiency in Health Care (IQWiG); 2006. In brief: How does dialysis work? 2018 Mar 8. Available from: https://www.ncbi.nlm.nih.gov/books/NBK492981/

[8] Novokhodko A, Du N, Hao S, Wang Z, Shu Z, Ahmad S, Gao D. Predicting the Impact of Polysulfone Dialyzers and Binder Dialysate Flow Rate on Bilirubin Removal. Bioengineering. 2024;11(12):1262.

[9] Jeffries M, Hamadeh F, Aberle T, Glenn S, Kamen DL, Kelly JA, et al. Haemolytic anaemia in a multi-ethnic cohort of lupus patients: a clinical and serological perspective. Lupus. 2008;17(8):739-43.

[10] Durán S, Apte M, Alarcón GS, Marion MC, Edberg JC, Kimberly RP, et al. Features associated with, and the impact of, hemolytic anemia in patients with systemic lupus erythematosus: LX, results from a multiethnic cohort. Arthritis Rheum. 2008;59(9):1332-40.

[11] Ward MM, Pyun E, Studenski S. Mortality risks associated with specific clinical manifestations of systemic lupus erythematosus. Arch Intern Med. 1996;156(12):1337-44.

[12] Miranda-Hernández D, Cruz-Reyes C, Monsebaiz-Mora C, Gómez-Bañuelos E, Ángeles U, Jara LJ, Saavedra MÁ. Active haematological manifestations of systemic lupus erythematosus lupus are associated with a high rate of in-hospital mortality. Lupus. 2017;26(6):640-645.