CASE REPORT

Twenty-five years of HIV treatment: sustained viral control but progressive metabolic and cardiovascular disease

Michał Biały, Małgorzata Inglot

Department of Infectious Diseases, Liver Diseases, and Acquired Immune Deficiencies, Wroclaw Medical University, Poland

Abstract

Long-term antiretroviral therapy (ART) provides durable viral suppression and extended life expectancy in people living with HIV (PLWH). However, metabolic, cardiovascular, and renal comorbidities frequently develop despite virologic control, reflecting the cumulative effects of aging, chronic inflammation, and long-term drug exposure.

We report a 25-year clinical course of a man diagnosed with HIV in 1993 who maintained viral suppression and stable CD4 counts for more than two decades. Despite excellent ART adherence and effectiveness, he developed metabolic syndrome and progressive dyslipidaemia, hypertension, carotid arteries stenosis, intermittent claudication, type 2 diabetes, hepatic steatosis, and ultimately end-stage renal disease requiring dialysis. Long-term exposure to several generations of antiretroviral agents, including stavudine, saquinavir, abacavir, and tenofovir disoproxil fumarate, likely contributed to metabolic and vascular toxicity. Social circumstances – homelessness, limited access to multidisciplinary care, and low health literacy regarding non-HIV conditions – hindered adequate prevention and treatment of comorbidities. The patient died in 2024 from myocardial infarction and sepsis.

This case illustrates that successful viral suppression alone does not prevent metabolic and cardiovascular complications in aging PLWH. Cumulative ART toxicity, lifestyle factors, and social determinants all contributed to an adverse outcome. Comprehensive care should integrate proactive risk-factor management, patient education, and close coordination between HIV and primary care services to improve long-term health and survival in this population.

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Key words: metabolic syndrome, HIV, chronic kidney disease, cardiovascular disease, comorbidities.

Introduction

Antiretroviral therapy (ART) achieves durable viral suppression and immune recovery in people living with HIV (PLWH); however, aging PLWH commonly develop cardiovascular, metabolic, and renal comorbidities earlier than the general population, owing to persistent immune activation, metabolic disturbances, and cumulative treatment exposure [1].

We report a 25-year single-patient history in which long-term virologic control coexisted with progressive dyslipidae-

Address for correspondence: Michał Biały, Department of Infectious Diseases, Liver Diseases and Acquired Immune Deficiencies, Wroclaw Medical University, 5 Koszarowa St., 51-149 Wroclaw, Poland, e-mail: m.bialy@umw.edu.pl

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mia, hypertension, diabetes, extensive atherosclerotic disease, and end-stage renal disease, leading to fatal cardiorenal failure.

The case illustrates interactions among traditional risk factors, ART-related toxicity, and social determinants of health, and it underscores the need for integrated preventive care.

Basic information about the patient

A man born in 1954 was diagnosed with HIV in March 1993. Occult hepatitis B (OBI) was detected in 2013; HCV was negative and HLA-B*5701 testing was negative. From 1999 (first available records) viral load remained undetectable, except for 3 blips/transient low-level viraemic episodes (2001, 2005, 2007); CD4 count stayed > 500/µl. He lived for many years in a Social Home for Homeless People with HIV and later moved to his family. He reported full adherence to ART, smoked ~20 cigarettes/day until quitting in March 2023, and was actively engaged in HIV community activities but showed limited health literacy for non-HIV care.

Changes in ART

Treatment regimens were changed repeatedly during follow-up as new agents emerged and comorbidities developed. Regimen timeline: see Figure 1.

Body mass ondex (BMI) increase

BMI rose gradually from 21.49 kg/m² (72 kg) in 1999, exceeding 25 kg/m² by 2007. A transient 8-kg loss occurred in 2013 (upon moving to a rural setting with improved living conditions), followed by rebound and peaking at > 28 kg/m² in 2020. Weight loss in the final years resulted from cachexia related to advanced illness. BMI timeline: see Figure 2B.

Hypertension, cardiovascular risk, dyslipidaemia, and their treatment

Hypertension (up to 200/100 mmHg) was first recorded in 2003, but pharmacological treatment was delayed until 2008 because of the patient's reported normal home readings and reluctance to start medication. Adequate control was achieved only in the final years with closer monitoring and frequent hospitalisations (Figure 2E).

Lipid abnormalities persisted throughout the observation period (Figure 2A and 2C). Low-dose atorvastatin was introduced in 2008, and fenofibrate was added in 2013.

Antihypertensive, lipid-lowering, antihyperglycaemic, and antiplatelet treatments are presented in Figure 1.

The patient's SCORE2 risk remained high for most of the observation period (Figure 2C).

Atherosclerotic cardiovascular disease (ASCVD): carotid artery stenosis, intermittent claudication, chronic heart failure

A carotid ultrasound (2008) showed atherosclerotic plaques with intimal-medial thickness (IMT) up to 1.2 mm and stenoses of 80% in the left internal carotid artery and 50-60% in the right internal carotid artery (Figure 3); the patient was asymptomatic and declined recommended endarterectomy. Intermittent claudication began in 2013 and worsened by 2018.

Echocardiography showed left chamber enlargement with LVEF 53% (2010) and later reduction to 40-50% (2023). Progressive degenerative changes of multiple valves were noted on those examinations. NT-proBNP rose across 2021-2023 (2021: 6700 pg/ml; 2022: 10,000 pg/ml; 2023: > 70,000 pg/ml), consistent with progressive heart failure.

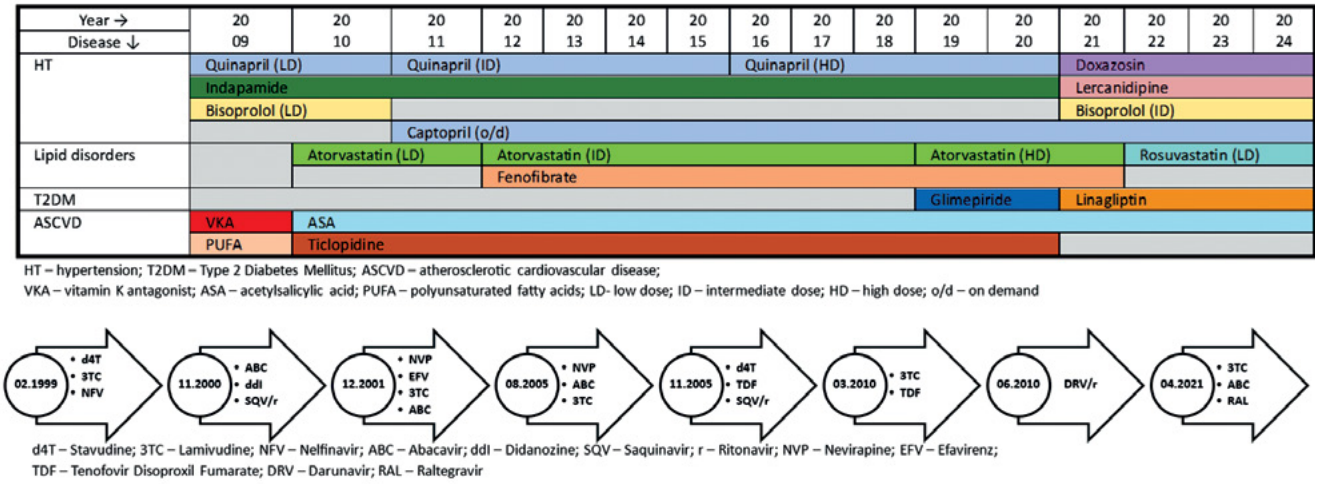
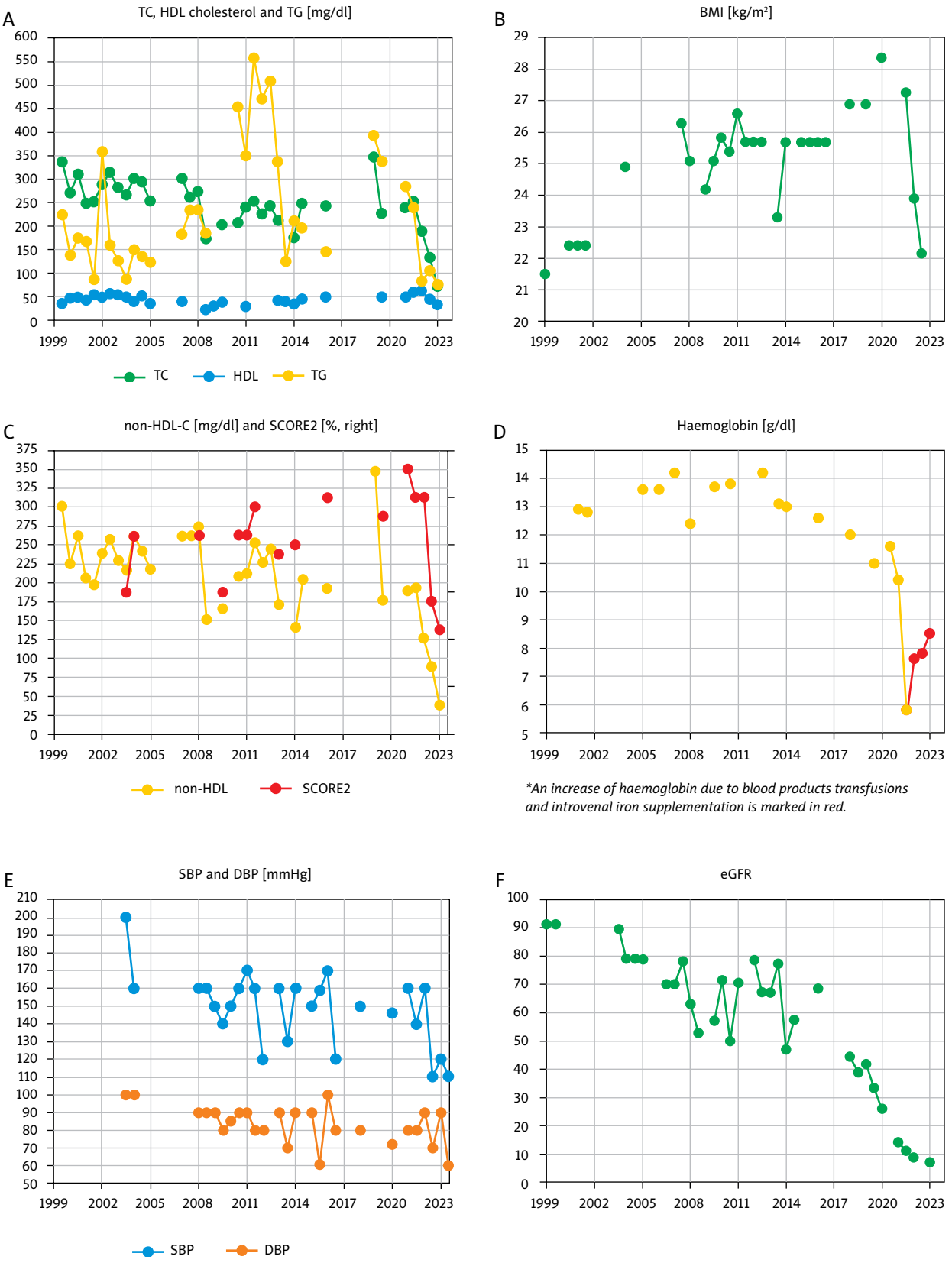


Figure 1. ART and other medication taken over the years



TC – total cholesterol, HDL – high-density lipoprotein, TG – triglycerides, BMI – body mass index, SBP – systolic blood pressure, DBP – diastolic blood pressure, eGFR – estimated glomerular filtration rate

Figure 2. Parameters over the years

Diabetes and steatotic liver disease

Prediabetic fasting glucose values appeared early; type 2 diabetes was diagnosed in 2019. Glimepiride was started and linagliptin added in 2021 with clinical improvement. Abdominal ultrasound (2014, 2021) showed hepatic steatosis; transaminases remained within normal limits.

Chronic kidney disease, anaemia, and dialysis

Renal function declined steadily and reached end-stage renal disease in 2021. Haemoglobin fell from 2011 onward; in May 2021 the patient was hospitalised with severe anaemia (Hb 5.8 g/dl), nitrogen retention, and metabolic disturbances, prompting blood transfusion and initiation of renal replacement therapy. Haemodialysis was performed 3 times weekly until October 2021, when it was temporarily discontinued; it was later resumed after recurrent admissions.

Kidney function timeline: see Figure 2F. Haemoglobin timeline: see Figure 2D.

Epilogue

In 2023 he was hospitalised once for pneumonia. On 28 September 2024 he was admitted after a fall and found to have myocardial infarction and multiple spinal and pelvic fractures. Sepsis and cardiac arrest occurred on 22 November 2024; he was resuscitated and transferred to intensive care, where he died on 27 November 2024.

Discussion

This case demonstrates that durable virologic control does not exclude substantial, progressive cardiometabolic and renal morbidity in aging PLWH. Traditional risk factors (smoking, obesity, hypertension, diabetes) acted together with chronic HIV-related inflammation and cumulative exposure to older ART drugs to produce a high overall burden of disease [2–4].

The patient's treatment history and drug exposures likely contributed to metabolic and renal complications described in the literature. Stavudine (d4T) is associated with mitochondrial toxicity, lipodystrophy, and insulin resistance [5]. Protease inhibitors such as nelfinavir and saquinavir may induce marked hypertriglyceridaemia and increased LDL-C [6]. Abacavir has been linked to endothelial dysfunction and increased cardiovascular risk, and it may accelerate carotid atherosclerosis [7]. Prolonged exposure to tenofovir disoproxil fumarate likely contributed to chronic kidney disease through tubular toxicity [8].

The presence of advanced carotid atherosclerosis by the mid-50s highlights accelerated vascular aging in PLWH, where immune activation and ART effects may amplify conventional risk [9–11]. The progression to renal failure was likely multifactorial, involving hypertensive and diabetic

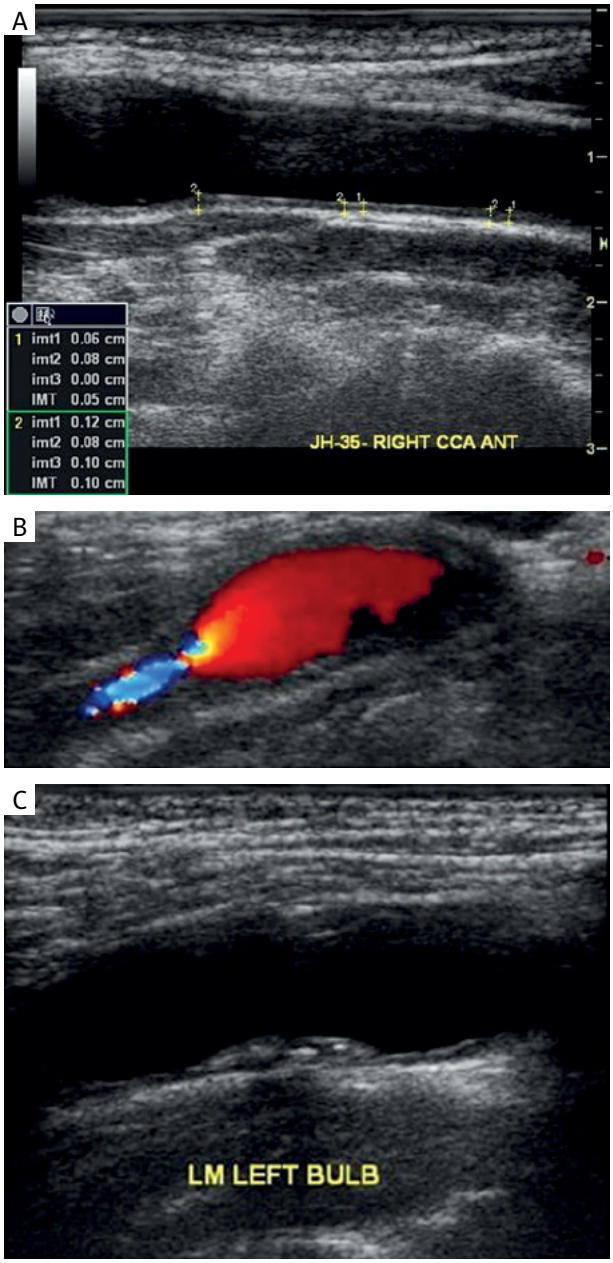


Figure 3. Carotid arteries ultrasound (2008)

injury, HIV-related renal disease, and nephrotoxic drug exposure [12].

Social determinants were important contributors. The patient demonstrated selective medical awareness. Regarding HIV, he demonstrated high adherence and strong engagement, stated by active participation in educational campaigns and knowledge contests to promote accurate information within his community. However, this commitment did not extend to non-HIV conditions, such as cardiovascular risk factors, diet, and routine health checks. Long-term living in a Social Home for Homeless People with HIV and care provided mainly in a specialized HIV ambulatory care provided virologic success, but the patient's contact

with broader multidisciplinary care was limited. Subsequent changes in residence (and therefore, primary care provider) may have further discourage the patient from seeking medical care continuity. Housing instability and low health literacy are associated with inconsistent engagement in medical services and poorer overall health outcomes in PLWH [13].

Several preventive opportunities were delayed. Antihypertensive therapy was initiated years after the first abnormal readings and statin therapy 9 years after noticing dyslipidaemia. Current guidelines for PLWH emphasize structured cardiovascular prevention: routine measurement of blood pressure, lipids and glucose; earlier statin initiation for elevated SCORE2 risk; smoking cessation and weight management; and consideration of ART choices to minimize metabolic toxicity [14–16]. For example, current European AIDS Clinical Society (EACS) Guidelines recommend annual SCORE-2 assessment and early statin initiation [14]. They also address hypertension and diabetes screening and management among PLWH. Also, European Society of Cardiology (ESC) recommends statin therapy in adults with HIV aged ≥ 40 years, even when traditional risk scores appear low, based on evidence from the REPRIEVE trial [15]. the HIV Medicine Association and Infectious Diseases Society of America (HIVMA/IDSA) Primary Care Guidance additionally highlights the importance of baseline glucose and HbA1c evaluation prior to ART initiation and ongoing metabolic monitoring [16].

Earlier and more intensive management of modifiable risk factors, combined with patient education and stronger engagement in non-HIV care, might have reduced cardiovascular burden and slowed kidney failure progression. However, the patient's limited acceptance of preventive measures, including refusal of vascular procedures, significantly restricted the impact of these strategies.

Conclusions

This case highlights the complexity of long-term care in aging PLWH. Despite successful viral suppression and immunologic stability, the patient developed multiple severe comorbidities, ultimately leading to death. This outcome reflects the combined influence of traditional (lifestyle) and HIV-related factors, and the impact of social determinants of health.

This case underlines the need for a comprehensive approach to PLWH care, including addressing broader health concerns beyond HIV treatment and education on prevention of metabolic comorbidities. Virologic control alone is insufficient to ensure healthy aging with HIV. Optimising lifestyle choices and behaviours, addressing health literacy gaps, and ensuring continuity of care across various specialties is crucial for improving long-term outcomes in PLWH.

While causality cannot be proven, this case emphasises that multifactorial guideline-based interventions (meaning cardiovascular and metabolic pretention) are a core component in the care of HIV-infected patients. While we discuss the patient's history from the current point of view, it should be stated that the guidelines regarding treatment of comorbidities in PLWH have become much stricter throughout this 25-year patient history.

Disclosures

1. Institutional review board statement: Not applicable. Written informed consent for publication was obtained from the patient's sister after his death.
2. Assistance with the article: None.
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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