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Massive Pulmonary Thrombosis Following Haemoptysis in Type IV Ehlers–Danlos Syndrome



Trombosis pulmonar masiva tras hemoptisis en el Síndrome de Ehlers–Danlos tipo IV

Dear Editor:

Ehlers–Danlos syndromes (EDS) are a group of rare genetic disorders that affect connective tissue, characterized by joint hypermobility, skin hyperextensibility, and tissue fragility. The majority of the currently recognized 13 EDS subtypes¹ are due to gene variants leading to impaired synthesis or structural abnormalities of different collagen types. Type IV or vascular EDS (EDS-IV) is an autosomal dominant multisystem disease caused by defects in type III collagen, encoded by the *COL3A1* gene, in chromosome 2 (2q32.2).¹ Type III collagen is a major constituent of the interstitial matrix in many tissues, including blood vessels. Accordingly, aneurysms and rupture of large arteries, spontaneous bowel perforation and uterine rupture during pregnancy are life-threatening complications of EDS-IV. EDS-IV is the most severe form of EDS, with most individuals dying before the 5th decade.¹ Pulmonary involvement may occur without extrathoracic manifestations,^{2–6} and the diagnosis of such cases may be made only at post-mortem examination.⁶ Spontaneous pneumothorax or haemopneumothorax are the most frequent complications, but cavity lesions, haemoptysis and pulmonary haemorrhage have also been reported.^{2–6}

Herein, we report the occurrence of severe haemoptysis associated with massive pulmonary thrombosis, with a fatal outcome, in a young adult male with EDS-IV. The patient's diagnosis was established by genetic testing in mid-adolescence, as soon as the family's pathogenic *COL3A1* (c.3517_3519del/p.(Gly1173del)) variant was identified. The patient had been free of significant EDS-related complications until the age of 17 years. The patient's father and one maternal aunt died from spontaneous aortic dissection/rupture, early in the 4th decade of life.

Our patient had a first hospital admission for haemoptysis at the age of 17. At the time, small areas of ground-glass opacities suggestive of alveolar haemorrhage were observed on chest computed tomography (CT). Over the next two years, he had occasional episodes of small-volume haemoptysis, often preceded by a tingling sensation in the head and neck.

At age 19, the patient needed hospitalization for large-volume haemoptysis. In the previous days, he had intermittent episodes of small-volume haemoptysis preceded by what he described as a “clicking” sensation in the head and, right-sided paraesthesia and mild motor weakness. The chest CT scan (late arterial phase) showed multiple bilateral ground-glass opacities suggestive of diffuse alveo-

lar haemorrhage and large fluid-filled cavities with air-fluid levels suggestive of haemorrhagic cavitation (Fig. 1A/B). Brain and cervical magnetic resonance (MR) imaging, MR angiography of the carotid and vertebrobasilar circulations, including the supra-aortic arches, and electroencephalogram were unremarkable. Despite the decrease in the haemoglobin level relative to baseline (respectively 15.3 g/dL and 13.8 g/dL), the patient remained hemodynamically stable without respiratory failure. Cough suppressive and antifibrinolytic therapies were initiated. Since the patient did not have any bronchial artery hypertrophy on CT scan and due to the high risk of vascular manipulation, bronchial arteriography was not performed. The surgical risk was also very high; therefore, the patient was not a candidate for thoracic surgery at that time.

A pulmonary CT angiography obtained on day 7 of hospital stay showed extensive bilateral thrombosis and an enlargement of the haemorrhagic parenchymal cavitation, but no actively bleeding arteries (Fig. 1C/D). There were no signs of deep vein thrombosis on Doppler ultrasound examination of the lower limbs. Despite the striking radiological signs, the patient remained asymptomatic. Transthoracic echocardiogram did not show any signs of right ventricular dysfunction, and the Pulmonary Embolism Severity Index (PESI) score was 29 (class I), translating into a low mortality risk.⁷ Given the high bleeding risk and the low overall risk stratification, hypocoagulation was not prescribed.

Two days later, the patient was admitted to the intensive care unit, following a syncope episode with echocardiographic evidence of right ventricular dysfunction. Anticoagulation with unfractionated heparin and inotropic support were instituted. After about 24 h of clinical stability, his haemodynamic condition suddenly deteriorated due to supraventricular tachycardia, followed by cardiac arrest that did not respond to advanced life support measures and thrombolysis. Autopsy was not performed.

To our knowledge, this is the first report of massive pulmonary thrombosis in a patient with EDS-IV seeking medical attention for recurrent haemoptysis. Arterial bleeding complications are typical of EDS-IV and several cases of severe haemoptysis, including with fatal outcomes, have been described.^{2,4,6} Platelet dysfunction may additionally aggravate the constitutional haemorrhagic propensity.⁸ Contrastingly, thrombotic events seem to be exceedingly rare in patients with EDS,⁹ but have been reported in EDS-IV^{10–12} and other EDS subtypes.^{9,13} In one of the EDS-IV cases, the patient had renal infarctions caused by emboli from a thrombotic renal artery aneurysm, and hypocoagulation was not prescribed either, with a favourable outcome.¹²

Major treatment decisions taken in our patient were based on validated risk stratification algorithms for pulmonary embolism/thrombosis⁷ and current clinical approaches to the management of haemoptysis.¹⁴ The delay in starting anticoagu-

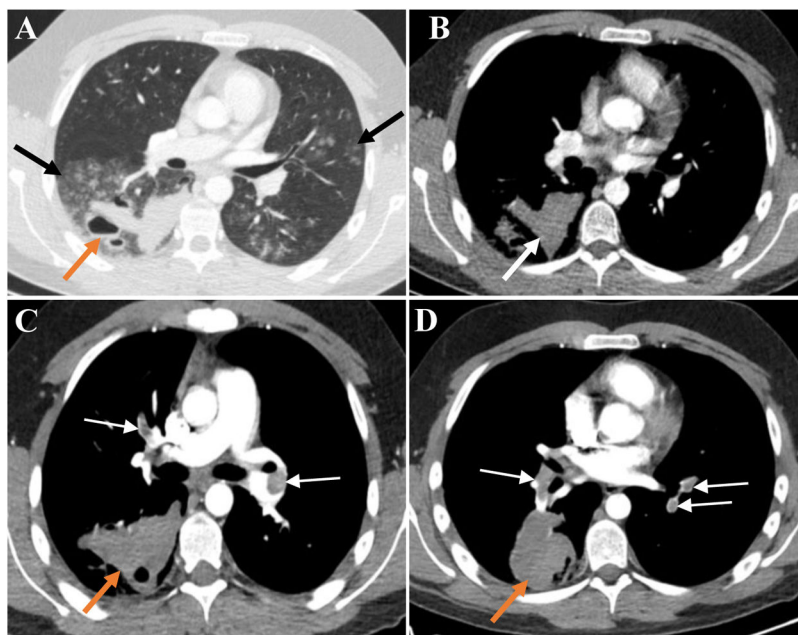


Fig. 1. (A) Late arterial phase chest CT depicts bilateral peribronchovascular groundglass opacities (GGO), especially in the right lower lobe (black arrows). In the right lower lobe thick-walled cavitory lesions with air–blood levels are also seen (orange arrow). The high density of blood-containing cavities is illustrated in B (white arrow). The GGO translate diffuse alveolar haemorrhage and the cavitory lesions result from the spontaneous rupture of the lung. There was no evidence of haemothorax or pneumothorax. (C and D) CT pulmonary angiographic study shows bilateral pulmonary thromboembolism (white arrows) and enlarged haemorrhagic cavity in the right lower lobe (orange arrows). No signs of pulmonary hypertension or right ventricular strain were present.

lation and the antifibrinolytic therapy might have facilitated the thrombotic event. Furthermore, haemostatic abnormalities were not screened, such as coexisting prothrombotic conditions or vitamin-D deficiency, which have been suggested as prognostic modulators in EDS-IV.^{8,11,15} However, taking into consideration the enlarging haemorrhagic cavitory lesion, the haemorrhagic propensity and the possibility of platelet dysfunction, the bleeding risk seemed to prevail when we decided not to initiate hypocoagulation therapy.

Despite the comprehensive neuroradiological and electroencephalographic evaluation, the aetiology of the neurological symptoms in close temporal association with the episodes of haemoptysis remained elusive, which is in line with previous observations in EDS-IV patients.^{3,4} In this case, a post-mortem examination could have been useful to characterize the lung pathology,^{4,6} as well as to elucidate the aetiology of the pulmonary embolism/thrombosis, but could not be carried out.

With this report, we aim to call the attention of respiratory physicians to this rare disorder, since haemoptysis, pneumothorax and pulmonary substance loss with cavitation can be the presenting manifestation of EDS-IV. Our patient illustrates the complexity of the pulmonary involvement in EDS-IV and the challenge of managing its haemorrhagic complications since the excessive vascular and tissue friability restricts diagnostic and therapeutic options. As in other rare, multisystem disorders, specific evidence-based treatment guidelines are not available, and patient care by multidisciplinary care teams is highly recommended.¹

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PD-1 Inhibitor for a Non-Small-Cell Lung Cancer Patient With Paraneoplastic Nephropathy



Tratamiento con un inhibidor de la PD-1 para un paciente con cáncer de pulmón no microcítico con nefropatía paraneoplásica

Dear Editor,

Paraneoplastic syndromes are clinical manifestations of spontaneous antitumor immune responses against antigen proteins expressed on tumor cells. The most common paraneoplastic nephropathy associated with solid tumors is membranous nephropathy (MN), and the estimated prevalence of tumors in patients with MN is around 10%.¹ And the majority of tumors related to MN are lung cancer.^{1,2}

The advent of an immune checkpoint inhibitor dramatically changed the treatment of various tumors. In metastatic non-small cell lung cancer (NSCLC), the inhibitors of programmed death 1 (PD-1) or programmed death-ligand 1 (PD-L1) significantly prolonged overall survival compared with that of chemotherapy and has become a standard treatment.^{3–5} Whereas, the PD-1/PD-L1 inhibitors may also clinically manifest unique side-effect profiles caused by T cells' action against self-antigens, known as immune-related adverse events (irAEs) and includes pneumonitis, colitis, rashes, hepatitis, pancreatitis, thyroiditis, and nephritis.^{6,7} In general, antitumor treatment is considered to improve paraneoplastic syndrome; however, little is known about the safety and efficacy of PD-1/PD-L1 inhibitors for patients with paraneoplastic syndrome. Here, we reported a patient treated using nivolumab, a PD-1 inhibitor, for NSCLC with paraneoplastic MN. A durable response to nivolumab was observed, without the exacerbation of nephrotic syndrome.

A 60-year-old man with peripheral edema due to hypoalbuminemia and proteinuria was diagnosed with nephrotic syndrome, and subsequent renal biopsy revealed MN. Although prednisolone and cyclophosphamide were administered, no improvement of nephrotic syndrome was observed. In addition, a nodule in the right upper lobe of the lung and multiple low-density areas in the liver on computed tomography developed during the treatment course. The biopsy samples from the lung demonstrated squamous cell carcinoma and he was diagnosed with stage IV non-small-cell lung cancer (NSCLC) harboring paraneoplastic MN. After the diagnosis of NSCLC, steroids and other immunosuppressive treatments were discontinued, whereas he received furosemide, lovastatin and candesartan for the management of nephrotic syndrome. Besides, cytotoxic chemotherapy of carboplatin plus S1 followed by docetaxel resulted in tumor regression accompanying the partial improvement of nephrotic syndrome; hypoalbuminemia and proteinuria improved (Fig. 1). After several months, however, nephrotic syndrome exacerbated and disease progression with metastatic lymph node enlargement also developed. At that time, nivolumab was approved for patients with previously treated NSCLC in Japan and he was treated using nivolumab. Thereafter, partial tumor response was achieved accompanying the partial remission of nephrotic syndrome (Fig. 1). The disease progressed four years after starting nivolumab, but paraneoplastic syndrome was not exacerbated during treatment.

One of the proposed mechanisms of paraneoplastic MN is the deposition of immune complexes formed by antibodies generated against an antigen identical to or an epitope similar to an endogenous podocyte antigen in the glomerular basement membrane beneath the podocytes.⁸ Therefore, the exacerbation of paraneoplastic syndrome due to heightened antitumor immune responses by PD-1/PD-L1 inhibitors directed against endogenous antigens

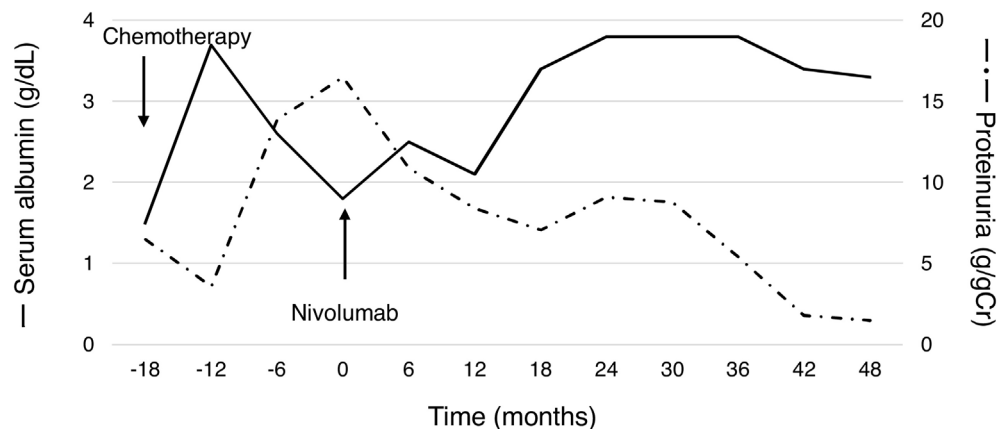


Fig. 1. Laboratory data related to nephrotic syndrome. The values of proteinuria were calculated by urine protein-to-creatinine ratio.