Case report

Respiratory failure due to concomitant interstitial lung disease and diaphragmatic involvement in a patient with anti-MDA5 dermatomyositis: a case report

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ABSTRACT

Diaphragm myositis is a rare manifestation of idiopathic inflammatory myopathies, barely portrayed in literature despite its potential severity. We describe a 57-year-old Caucasian male with anti-MDA5 positive dermatomyositis, that had a 4-month history of progressive dyspnoea requiring oxygen-therapy, scarcely responsive to prednisolone. Chest high resolution computed tomography (HRCT) showed mild interstitial lung disease (ILD), whereas pulmonary function tests evidenced severe restrictive syndrome with high lung ultrasound score. Diaphragm ultrasound revealed a marked diaphragm dysmotility, confirmed by electromyography (EMG). The patient was treated with intravenous immunoglobulins and mofetil mycophenolate with progressive improvement of dyspnoea, lung volumes and ILD at CT scan. Ultrasound examination also revealed marked improvement of the diaphragmatic disfunction and a reduction of lung ultrasound score. The use of ultrasound may provide a valuable tool in the diagnosis of diaphragm myositis, which may play a major role in the respiratory impairment of these patients. A combined lung and diaphragm examination allowed bedside monitoring of the improvements in both lung aeration and diaphragm contractility.

Introduction

Patients with idiopathic inflammatory myopathies (IIMs) may present dyspnoea or even respiratory failure (RF) mainly due to interstitial lung disease (ILD). The involvement of respiratory muscles, although rarely reported, is another possible cause of dyspnoea/RF in IIMs.

Here, we report the case of a dermatomyositis presenting with RF due to concomitant ILD and diaphragm myositis, first assessed by combined lung (LUS) and diaphragm ultrasound (DUS), and responsive to high dose intravenous immunoglobulins (IVIG), corticosteroids, and mycophenolate mofetil.

Clinical vignette

A 57-year-old Caucasian man with a previously unremarkable medical history, developed RF in September 2020, leading at first to O_2 therapy. Chest high resolution computed tomography (HRCT) showed an organising pneumonia (OP). SARS-CoV-2 infection was excluded at both nasal swab and broncho-alveolar lavage. Prednisolone 40 mg/daily was started with minimal benefit. The December 2020 chest HRCT showed mild reduction of ground glass opacities (GGO) and appearance of patchy fibrotic lesions. In January 2021 we evaluated the patients for the first time, with evidence of Gottron's papules/sign, heliotrope rash, V-sign rash, and mechanic's hands. His manual muscle testing on eight muscles (MMT8) was normal (150/150).

Blood tests showed normal serum creatine phosphokinase (CPK 21 mU/ml, ULN 190), and a slight increase of aldolase (9 U/L, ULN 7.6). Antinuclear (1/80 speckled pattern) and anti-MDA5 antibodies were positive. A diagnosis of dermatomyositis was made. Due to the persistent RF, the patient was admitted to our Unit. The electromyography (EMG) showed myopathic findings (bilateral quadriceps femori), confirmed by magnetic resonance (MR). LUS showed a diffuse B-pattern (global lung ultrasound score 15). Pulmonary function tests (PFTs)

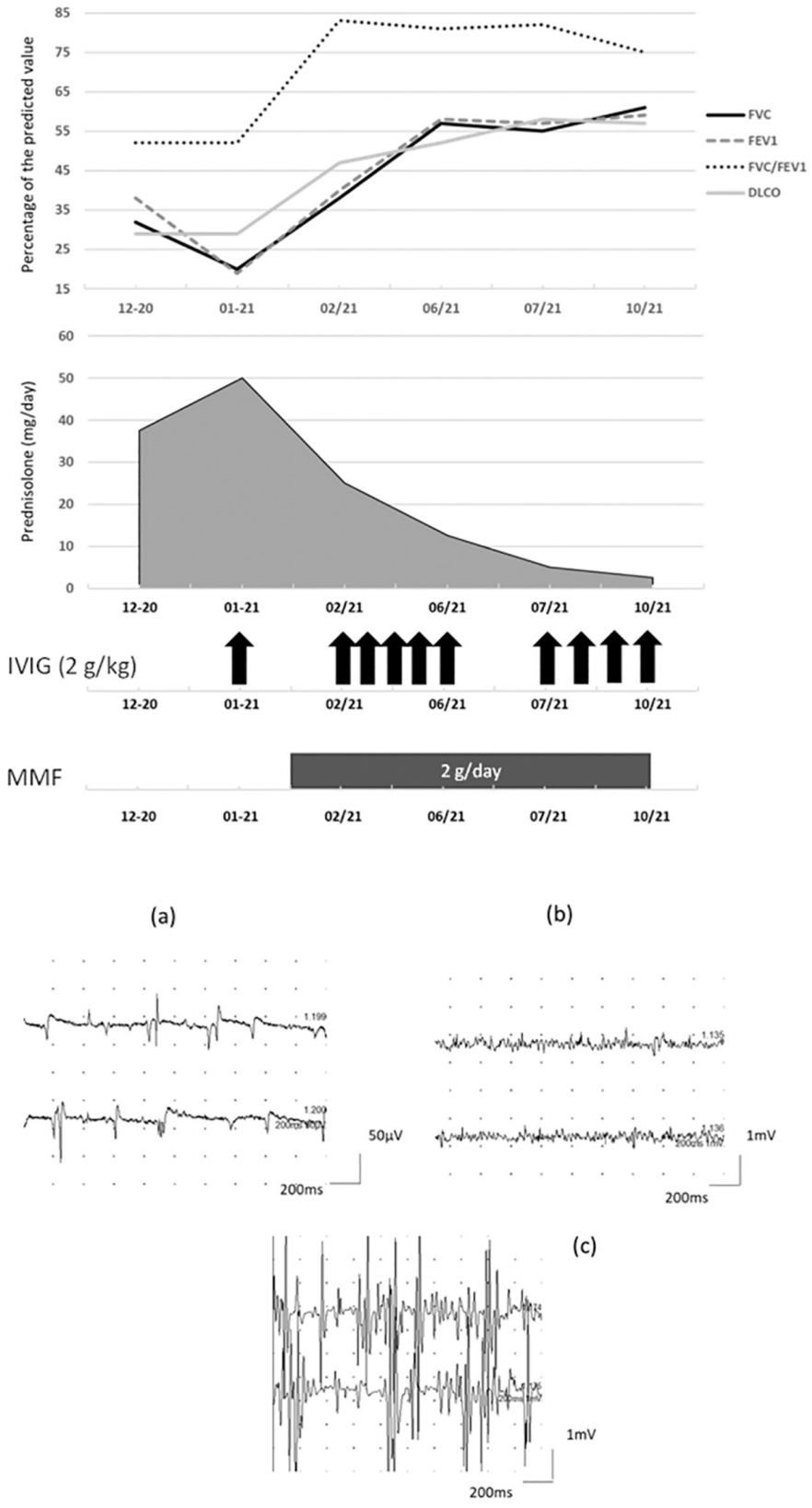

Fig. 1. Modification of forced vital capacity (FVC) and diffusion lung CO (DLCO) and their temporal correlation with IVIG courses, prednisone dosage and mofetil mycophenolate (MMF) treatment. EMG investigations of the emidiaphragm and first dorsal interosseous muscles (rigth side). (a)Spontaneous activity (fibrillations and positive sharp waves) in emidiaphragm. (b) Motor unit potential recruitment in emidiaphragm showing a typical myopatic pattern. (c) Motor unit potential recruitment in first dorsal interosseous muscle showing a normal pattern.

showed a severe restrictive deficit not in line with the HRCT findings, and a slight reduction of diffusing capacity of the lungs for carbon monoxide (DLCO). Respiratory muscle involvement was suspected. DUS showed left hemidiaphragm moderate impairment, with both thickening fraction and displacement at lower values of normality range (20% and 2.17 cm, respectively). Right hemidiaphragm was more clearly dysfunctional, with reduced thickening fraction (15.1%) and impaired displacement (1.1 cm), particularly remarkable during forced inspiration (maximal displacement 2.0 cm) [see LUS video here: https://drive.google.com/file/d/1jCQVMuM1pmmfDsRxu9MxGHM9wjpM7zW/view?usp=sharing]. Surface EMG of the right diaphragm confirmed a mixed neural and myogenic sufferance. IVIG 2g /kg were started, and prednisolone increased to 50 mg/day, with marked benefit. Dyspnoea reduced, diaphragm motility improved, together with lung volumes and DLCO and lung aeration improved with a normalisation of the lung ultrasound score. In the following 6 months the patient was treated with monthly cycles of IVIG (2 g/kg/month) and mofetil mycophenolate 2000 mg/day with further improvement of dyspnoea, HRCT findings and PFTs, with progressive reduction of O_2 therapy and corticosteroids (currently 2.5 mg/day). In Table I we reported the changes of LUS and DUS observed overtime, in Figure 1 the changes in PFTs, together with performed treatments observed, and the basal diaphragm EMG findings observed.

Discussion

Anti-MDA5 DM is a rare disease that encompasses characteristic skin lesions, as heliotropic rash, Gottron's papule and signs and mechanic hands, minimal or absent muscle disease and ILD which could be rapidly-progressive.

We reported the case of a dermatomyositis patients in which RF was due to concomitant ILD and diaphragm myositis. Of note, diaphragm myositis was the only clinically relevant muscle involvement the patient presented.

Till now, data about diaphragmatic

Table I. Left diaphragm measures at the admission in our Department (January and February), and at last follow-up.

	Jan. 2021	Feb. 2021	June 2021
Diaphragm ultrasound			
Right			
Expiratory thickness (cm)*	0.18	0.18	0.18
Inspiratory thickness (cm)*	0.21	0.21	0.30
Thickening fraction (%)*	15.09	18.52	25.45
Excursion – normal inspiration (cm)*	1.10	1.07	1.47
Excursion – forced inspiration (cm)*	2.00	2.10	3.40
Left			
Expiratory thickness (cm)*	0.20	0.20	0.19
Inspiratory thickness (cm)*	0.24	0.24	0.26
Thickening fraction (%)*	20.00	21.67	36.84
Excursion – normal inspiration (cm)*	2.17	2.07	2.00
Excursion – forced inspiration (cm)*	3.70	3.90	4.10
Lung ultrasound			
Right LUS score	6	8	1
Left LUS score	9	9	0
Global LUS score	15	17	1

*Mean values of three consequent measures. LUS: lung ultrasound.

myositis in IIMs are scarce, with only 4 cases reported from 1984. Three patients had polymyositis, one case presented with both diaphragm and intercostal muscle myositis and resulted fatal (1) while the other two required mechanical ventilation due to ARDS and, in one case, resuscitation after a cardiac arrest. Both patients survived after being treated with oral steroids and, in one case, IVIG (2, 3). The only dermatomyositis patient reported was successfully treated with IVIG and high doses of corticosteroids (4).

All these patients were admitted in ICU for severe acute respiratory failure. Diaphragm involvement was evidenced respectively by autopsy (1), from the impossibility to trigger voluntary inspiratory pressure despite the aid of an artificial ventilator (2), by PFT and phrenic nerve stimulation (3), and by diaphragm MR imaging (4). Despite the few reports, one longitudinal study on 23 IIMs, found that the prevalence of diaphragm weakness (defined as a mouth pressure produced by phrenic stimulation <10 mmHg) exceeded 75% and, interestingly, was more severe in patients with DM (5).

In all these studies the assessment of respiratory muscle involvement was difficult and limited by the not easily availability and invasiveness of reference tool for diagnosis, that is diaphragm EMG.

The increasing use of DUS to explore the respiratory system both in adults and children can be a good and reliable solution to this problem, since it is widely available and not invasive. The growing interest in this topic has led to the development of standardised methods and reference values for the assessment of diaphragm function (6). With this case we showed that the occurrence of diaphragm involvement in IIMs should be considered, even when ILD is present, and that DUS may be a reliable screening and monitoring tool for this potentially dreadful condition.

Competing interests

S. Mongodi received fees for lectures from GE Healthcare, outside the present work. F. Mojoli received fees from GE Healthcare, Hamilton Medical, SEDA SpA, outside the present work. A research agreement is active between the University of Pavia and Hamilton Medical, outside the present work.

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