Abstract:
We herein report a 26-year-old woman with sudden cardiac arrest who had no remarkable medical history. While resuscitation was successfully performed with adrenalin administration and extracorporeal membrane oxygenation, the cause of cardiac arrest could not be determined for over two weeks. Given the presence of autoimmune disease along with the findings of refractory renal insufficiency and thrombocytopenia, a kidney biopsy and blood examinations, including lupus anticoagulant testing, were performed, which proved the presence of antiphospholipid syndrome. The patient was successfully treated with steroid pulse therapy. This drastic case scenario highlighted the fact that autoimmune disease can be the cause of sudden cardiac arrest.

Key words: sudden cardiac arrest, catastrophic antiphospholipid syndrome, antiphospholipid syndrome, intensive care

Introduction
Antiphospholipid syndrome (APS) is a systemic autoimmune disorder characterized by venous and/or arterial thrombosis and accompanied by positive levels of antiphospholipid antibodies. In addition to these characteristics, catastrophic antiphospholipid syndrome (CAPS) is defined when the manifestations of APS develop in multiple organs simultaneously or in less than one week. As thromboembolic events related to CAPS develop in multiple organs, the syndrome itself can manifest in a variety of ways (1).

We herein report a young woman who survived sudden cardiac arrest due to CAPS.

Case Report
A 26-year-old woman with no remarkable medical history visited her general practitioner due to chest discomfort with the following vital signs: pulse rate 130 beats per minute (regular rhythm) and respiratory rate of 30 per minute. An electrocardiogram performed by the general practitioner showed sinus tachycardia with no evidence of ST elevation or hypertrophy (Fig. 1). Peripheral oxygen saturation could not be measured due to systemic cyanosis. Furthermore, chest X-ray revealed bilateral pulmonary edema, and echocardiography showed a significantly impaired left ventricular systolic function with an ejection fraction of 20.3%. The patient was therefore transferred to our tertiary medical center to receive intensive care.

Since she suffered cardiopulmonary arrest (initial rhythm: pulseless electrical activity [PEA]) refractory to resuscitation just before her arrival at our facility, veno-arterial extracorporeal membrane oxygenation (VA-ECMO) was performed immediately after arrival. Initial blood testing showed multiple organ failure, including acute kidney injury (Cre: 7.00 mg/dL), elevation of liver enzymes (ALT: 473 U/L, AST: 324 U/L), disseminated intravascular coagulation (platelet count: 25,000/μL, FDP: 18.5 μg/mL), metabolic acidosis (pH: 6.71, base excess: −29.7 mmol/L, HCO3−: 3.4 mmol/L, lactate: 186 mg/dL), elevated brain natriuretic peptide (BNP; 6,839 pg/mL), and elevated troponin I (5.43 ng/mL). The results of a blood examination performed in the emergency department are shown in Table 1.

The multiple organ failure was initially attributed to either fulminant myocarditis or acute myocardial infarction; how-
Table 1. Blood Findings and the Results of a Rapid Influenza Check on Admission.

| Biochemistry | | Peripheral blood |
|--------------|----------------------------------|-----------------|
| Alb          | 2.5 g/dL                         | RBC 3.05 × 10⁶ /μL |
| CK           | 265 U/L                          | WBC 10170 /μL    |
| CK-MB        | 54 IU/L                          | Hb 7.9 g/dL      |
| AST          | 473 U/L                          | Hct 26.6 %       |
| ALT          | 324 U/L                          | Pit 25000 /μL    |
| LDH          | 1832 U/L                         | FDP 18.5 μg/ml   |
| Cre          | 7.00 mg/dL                       | Fibrinogen 240 mg/dL |
| eGFR         | 6.7 ml/min/1.73m²                | Arterial blood gas test on arrival at Emergency department |
| BUN          | 53.4 mg/dL                       | Fio2 100%        |
| Na           | 133 mmol/L                       | pH 6.71          |
| K            | 8.0 mmol/L                       | PaCO2 27.8 mmHg  |
| Cl           | 98 mmol/L                        | PaO2 135.0 mmHg  |
| Troponin I   | 5.43 ng/mL                       | HCO₃⁻ 3.4 mmol/L |
| BNP          | 6839 pg/mL                       | Base Excess -29.7 mmol/L |
| CRP          | 1.86 mg/dL                       | Anion gap 26.8 mEq/L |
|              |                                  | Lactate 186 mg/dL |

Rapid influenza check negative result

Table 2. Laboratory Findings of Immunological Testing.

| Test                        | Value     | Normal range |
|-----------------------------|-----------|--------------|
| *Antinuclear antibody*      | 56.2      | (-40)        |
| Anti DNA antibody           | 6.70 IU/ml| (-6.0 - 10 IU/ml) |
| Anti ds-DNA antibody        | 14 IU/ml  | (-10 - 10 IU/ml) |
| Anti Sm antibody            | 10.2 U/mL | (-10 - 10 U/ml) |
| Anti cardiolipin antibody   | 33 U/mL   | (-10 - 10 U/ml) |
| Lupus anticoagulant        | 2.35      | (-1.3)       |
| IgG                         | 82.2 mg/dL|              |
| IgA                         | 199 mg/dL |              |
| IgM                         | 58 mg/dL  |              |
| CH50                        | <10.0 U/mL|              |
| C3                          | 54 mg/dL  |              |
| C4                          | 4 mg/dL   |              |
| PR3-ANCA                    | <1.0 U/mL |              |
| MPO-ANCA                    | <1.0 U/mL |              |

ADAMTS-13 inhibitor activity : negative result

*Normal range

However, the latter was denied due to coronary angiography showing no evidence of occlusion.

Cardiopulmonary support with VA-ECMO was terminated two days after admission based on the finding of slight improvement in her left ventricular ejection fraction. However, intermittent renal replacement therapy (IRRT) and blood transfusion with platelet concentrates were continued for over two weeks due to sustained kidney injury and severe thrombocytopenia, respectively. Autoimmune disease was suspected because of the sustained kidney dysfunction and severe thrombocytopenia despite the stabilization of the systemic condition, and blood testing on the 20th day of admission showed positive results for lupus anticoagulant (Table 2).

A renal biopsy was then performed, which demonstrated the presence of a small renal artery thromboembolism and
segmental glomerulosclerosis (Fig. 2). CAPS was therefore diagnosed based on positive lupus anticoagulant findings, the rapid development of manifestations, pathological findings of the renal biopsy, and diffusion-weighted imaging of brain magnetic resonance imaging (MRI) showing multiple thromboembolic cerebral infarctions (Fig. 3). Concurrent systemic lupus erythematosus (SLE) was also diagnosed based on the established criteria (Systematic Lupus Erythematosus Disease Activity Index score of 21 points) (2).

After the diagnosis, the patient was treated with warfarin (target PT-INR (prothrombin time internal normalized ratio): 2.0-3.0), intravenous methylprednisolone pulse therapy (1,000 mg/day for 3 days), and subsequent oral prednisolone therapy (1 mg/kg/day). As shown in the clinical time course in Fig. 4, the severe kidney dysfunction and thrombocytopenia normalized after methylprednisolone pulse therapy. Finally, hemodialysis therapy was able to be terminated. In addition, the patient’s reduced motor function due to long-term bed rest was significantly improved with daily cardiac rehabilitation, and her subsequent clinical course was uneventful after being transferred to the general ward. Both the clinical cardiac status and echocardiogram findings were nearly normalized.

**Discussion**

CAPS, systemic autoimmune disorder characterized by venous and/or arterial thrombosis, includes many symptoms because of micro-thromboembolic event-related multiple organ failure. In addition, the diagnosis of CAPS is challenging in patients who suffer cardiopulmonary arrest as the first manifestation of CAPS, as in the present case. The mortality of CAPS remains high despite combination therapy with corticosteroids, intravenous immunoglobulin, plasma exchange, and anticoagulants, which makes the early diagnosis all the more crucial (3).

Regarding the etiology of CAPS-related acute cardiac failure, a number of different causes have been described, including macrovascular (4) or microvascular coronary artery embolization (5), valve involvement (6), fulminant myocarditis (7), and severe hypoxemia. In the present case, we failed to confirm the presence of microvascular coronary artery embolization or myocarditis since a cardiac biopsy or gadolinium-enhanced cardiac MRI could not be performed due to the patient’s severe thrombocytopenia and kidney dysfunction. However, the persistent severe thrombocytopenia and kidney dysfunction despite dialysis therapy, blood transfusion, and improvement of other symptoms were key features suggesting the presence of autoimmune disorder.

Steroid pulse therapy drastically improved the general condition and led to the complete recovery of this patient with CAPS. However, the suitability of steroids as an empirical therapy for cryptogenic cardiac arrest is still being debated, as steroid therapy can worsen the prognosis of pa-
The authors state that they have no Conflict of Interest (COI).

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