

VIDEOS IN EMERGENCY MEDICINE

Infectious Disease

Woman with dyspnea after skin rash

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1 | CASE PRESENTATION

Herpes zoster (HZ) is a common disease caused by reactivation of the varicella zoster virus (VZV) in the dorsal root ganglion.¹ Rarely, VZV infection can cause phrenic nerve paralysis involving the C3 to C5 motor nerves.² As diaphragmatic paralysis causes respiratory failure, it must be promptly diagnosed and treated.³ Here, we present a case of acute diaphragmatic paralysis attributed to VZV infection diagnosed using electrophysiological and ultrasound examinations. Ultrasound evaluation and phrenic nerve conduction study (NCS) are recommended in patients with HZ in the C3 to C5 region who exhibit dyspnea; diaphragmatic paralysis should be considered.

2 | NARRATIVE

An 88-year-old woman presented with erythema with blisters on the right shoulder that spread to the entire body. Three weeks later, she was referred to a dermatology clinic; her condition was diagnosed as HZ. The next day, she was admitted to our hospital with dyspnea and weakness in the proximal right upper limb. She had been diagnosed with bronchial asthma, chronic heart failure, and chronic kidney disease. On admission, she showed tachypnea and oxygen saturation of 85% (room air) with a labored breathing pattern involving the sternocleidomastoid muscles. Multiple erythematous papules and erosions were clustered around the right C4 dermatome (Figure 1A). Erythematous papules were scattered throughout the body, and most were crusted. Neurological examination revealed severe muscle weakness in the right C5 region; the muscle strength of the shoulder abductor

and elbow flexor muscles was Medical Research Council grade 2/5. No other neurological abnormalities were noted. Arterial blood gas analysis under 3L oxygen administration showed pH 7.24, partial pressure of oxygen was 75.9 mmHg, partial pressure of carbon dioxide (pCO₂) was 61.5 mmHg, and bicarbonate was 27.7 mmol/L; she was positive for serum VZV immunoglobulin (Ig) M and IgG. Cerebrospinal fluid (CSF) examination revealed an increased cell count (33/μl; 100% mononuclear cells), a mildly increased protein content (74 mg/dL), normal glucose levels (88 mg/dL; paired serum glucose 142 mg/dL), and a positive polymerase chain reaction result for VZV DNA. Chest radiography showed an elevated right diaphragm compared with that in previous images (Figure 1B). Cervical magnetic resonance imaging showed no signs of myelopathy or degenerative changes. The action potential of diaphragm compound muscles was not evoked on the right side, as evaluated using the phrenic NCS, although the amplitude on the left side was 360 μV from baseline to peak (normal, 330–1110 μV) (Figure 2A). Ultrasound evaluation showed that the right diaphragm was immobile but not atrophic; the left diaphragm showed normal movements (Figure 2B), suggesting right phrenic nerve paralysis and C5 paresis induced by VZV infection. On admission, pulsed methylprednisolone injection (1000 mg/day for 3 days), acyclovir (1500 mg/day for 14 days), and non-invasive positive pressure ventilation (NPPV) were administered. Although NPPV was discontinued the next day as a result of delirium, chest radiography showed improved atelectasis, pCO₂ decreased to 40.7 mmHg, and dyspnea was relieved. Subsequently, oral prednisolone (50 mg/day) was administered and was tapered over a total of 2 weeks. Although phrenic nerve palsy and weakness in the right C5 region were not alleviated during the next several months, she did not complain of dyspnea without NPPV.

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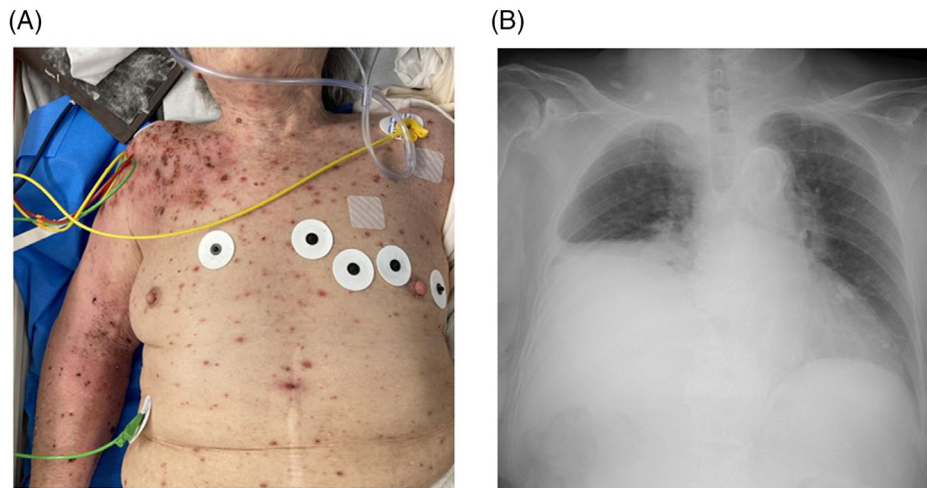


FIGURE 1 (A) Clinical findings at the first visit. Erythematous papules clustered around the right C4 dermatome and scattered over the entire body. (B) Radiological findings at first visit. Elevation of the right diaphragm is apparent.

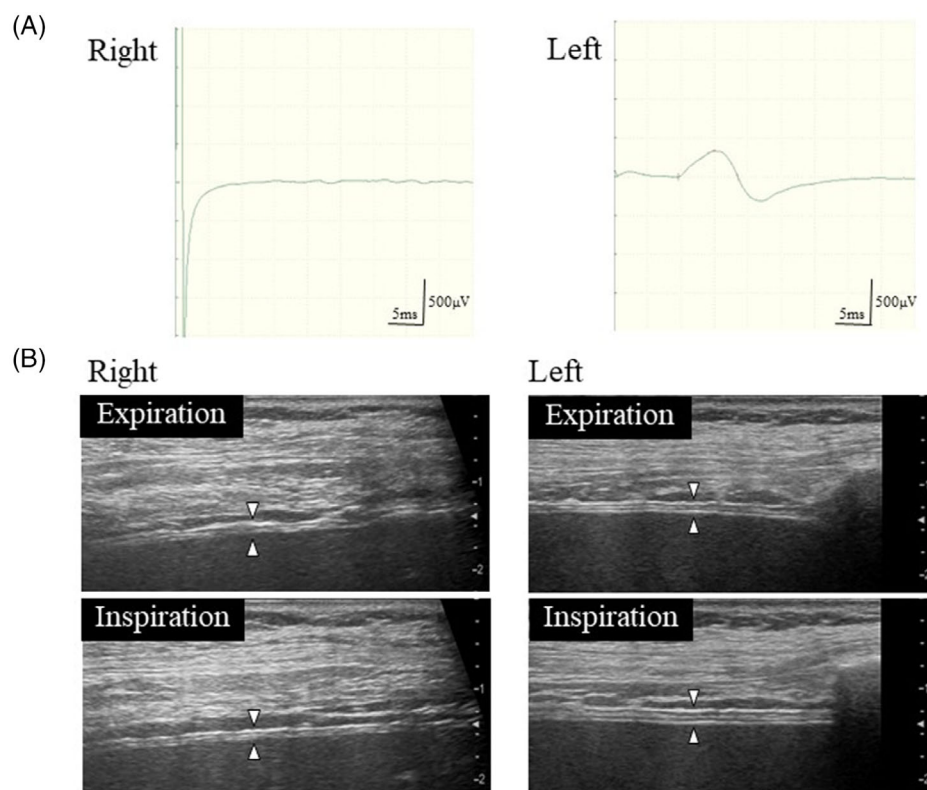
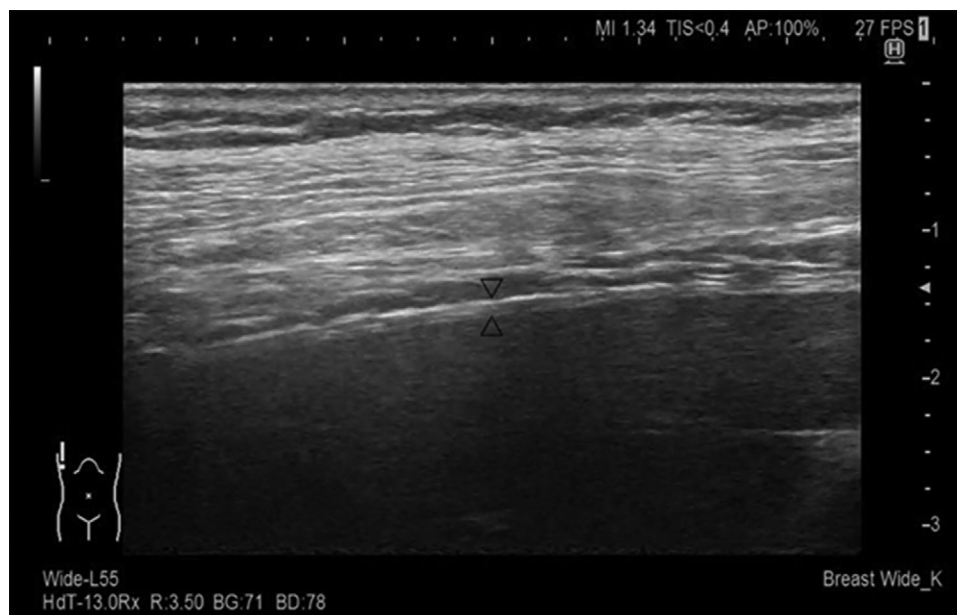


FIGURE 2 (A) Nerve conduction study of the phrenic nerve. Compound muscle action potentials were not evoked on the right side, although normal responses were observed on the left side. (B) Ultrasound findings pertaining to the diaphragm. The right diaphragm of the patient at the end of expiration and inspiration (thickness, 1.2 mm for both). The left diaphragm of the patient at the end of expiration and inspiration (thickness, 1.2 mm and 1.6 mm, respectively). The distance between the 2 arrowheads indicates the thickness of the diaphragm.

3 | DIAGNOSIS: DIAPHRAGMATIC PARALYSIS ATTRIBUTED TO VARICELLA ZOSTER VIRUS

In this case, diaphragmatic paralysis attributed to VZV infection was confirmed using ultrasound evaluation (Video 1) and NCS and supported by detection of VZV DNA in the CSF. Phrenic nerve paralysis

is a rare condition in patients with HZ in the C3 to C5 region. As Melcher et al reported a fatal case in which the patient required ventilator support, prompt diagnosis and treatment are required.³ Direct evaluation of the diaphragm using NCS and/or ultrasound is important for the diagnosis of diaphragmatic paralysis. Ultrasound examination can be performed at the bedside and allowed a rapid



VIDEO 1 Ultrasound finding. The right diaphragm was immobile but not atrophic; the left diaphragm showed normal movements.

diagnosis in our case. Despite the absence of diaphragmatic atrophy, the right diaphragm was immobile, indicating acute diaphragmatic paralysis. As diaphragmatic paralysis attributed to VZV infection is unilateral, it can be easily diagnosed on NCS or ultrasound assessment by comparing the affected side with the contralateral healthy side.

A previous study reported that VZV infection-caused diaphragmatic paralysis is associated with a poor prognosis.² Waki et al reported a case of rapid improvement in diaphragmatic paralysis after acyclovir and steroid pulse therapy.⁴ Ramsay-Hunt syndrome is also caused by VZV, and a combination of acyclovir and steroids is the most effective treatment.⁵ We administered steroids and acyclovir; however, the diaphragmatic paralysis did not improve for several months. The effectiveness of steroids may vary depending on the disease severity and duration. Settling this issue would require the evaluation of additional cases.

In conclusion, ultrasound evaluations and NCS are recommended in patients with HZ in the C3 to C5 region who exhibit dyspnea; diaphragmatic paralysis should be considered. Acyclovir and steroids may be effective treatment options in such patients.

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