

Special Edition  
"Revisiting Physical Diagnosis in  
Respiratory Medicine"

## Case Report

### \*Corresponding authors

**Takeshi Saraya, MD, PhD**  
Assistant Professor  
Department of Respiratory Medicine  
Kyorin University School of Medicine  
6-20-2 Shinkawa, Mitaka City  
Tokyo 181-8611, Japan  
Tel. +81 (0) 422 44 0671  
Fax: +81 (0)422 44 0671  
E-mail: [sara@yd5.so-net.ne.jp](mailto:sara@yd5.so-net.ne.jp)

### Taro Minami, MD

Assistant Professor of Medicine  
Divisions of Pulmonary  
Critical Care and Sleep Medicine  
Memorial Hospital of Rhode Island  
The Warren Alpert Medical School of  
Brown University  
Pawtucket, RI, USA  
Tel. +1-401-729-2635  
E-mail: [nantaro@gmail.com](mailto:nantaro@gmail.com)

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# Diaphragm Ultrasonography as a Tool to Assess Paradoxical Breathing in a Patient With Asthma Attack

Sunao Mikura, MD<sup>1</sup>; Takeshi Saraya, MD, PhD<sup>1\*</sup>; Taro Minami, MD<sup>2\*</sup>; Toru Satoh, MD, PhD<sup>3</sup>; Keisuke Oda, PhD<sup>4</sup>; Hisako Shinbara, PhD<sup>5</sup>; Sadatomo Tasaka, MD, PhD<sup>6</sup>; Hiroshi Kuraishi, MD, PhD<sup>7</sup>; Hajime Takizawa, MD, PhD<sup>1</sup>

<sup>1</sup>Department of Respiratory Medicine, Kyorin University School of Medicine, Miatka City, Tokyo, Japan

<sup>2</sup>Divisions of Pulmonary, Critical Care and Sleep Medicine, Memorial Hospital of Rhode Island, The Warren Alpert Medical School of Brown University, Pawtucket, RI, USA

<sup>3</sup>Department of Cardiology, Kyorin University School of Medicine, Miatka City, Tokyo, Japan

<sup>4</sup>Departments of Component Technology, Engineering Operation, Automotive OEM Business Division, JVC Kenwood Corporation, Tokyo 192-8525, Japan

<sup>5</sup>Departments of Development, Engineering Operation, Media Business Division, JVC Kenwood Corporation, Tokyo 192-8525, Japan

<sup>6</sup>Department of Respiratory Medicine, Hirosaki University School of Medicine, Hirosaki 036-8562, Japan

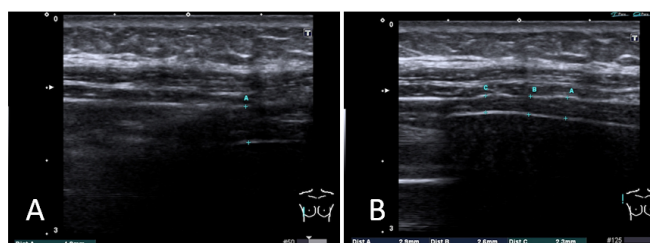
<sup>7</sup>Department of Pulmonology, Nagano Red Cross Hospital, Nagano 380-8582, Japan

**KEYWORDS:** Diaphragm ultrasonography; Paradoxical breathing; Respiratory distress; Asthma attack.

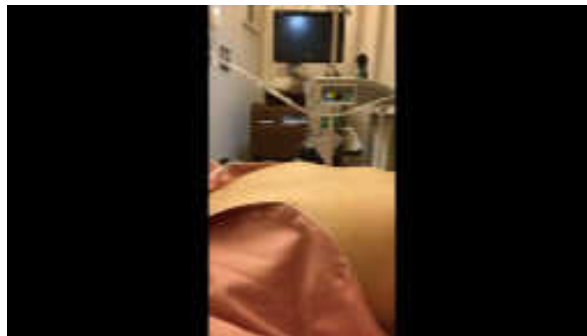
### CASE REPORT

A 67-year-old woman experienced chronic dyspnea, wheezes, and dry cough for 1 year and was admitted to our hospital. She had no remarkable medical history. Her dyspnea worsened over 2 months and was admitted to the hospital for further diagnostic and therapeutic interventions.

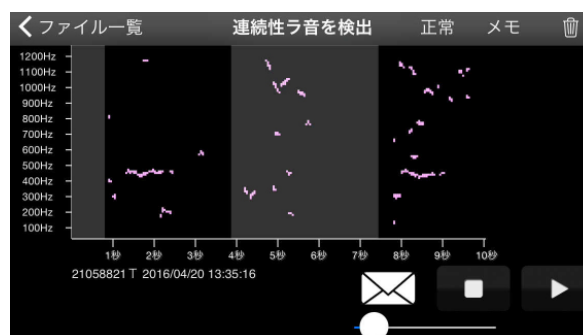
On examination, the patient was in respiratory distress. The blood pressure, pulse rate, respiratory rate, temperature, and oxygen saturation were 158/108 mmHg, 108 beats per minute, 30 breaths per minute, 36.4 °C, and 92%, respectively while she was breathing ambient air. Physical examination revealed paradoxical breathing with the chest wall moving inwards during inspiration and outwards during expiration (Video 1) together with diffuse inspiratory and expiratory wheezes of Jonson Grade 3 (Video 2). Diaphragm ultrasonography was performed to assess her respiratory failure, which revealed a normally functioning diaphragm, i.e. it descended during the inspiratory phase and ascended during the expiratory phase (Video 3) with a normal contraction (thickness of the diaphragm (tdi); Figure 1A: tdi at end-inspiration, 4.9 mm; Figure 1B: tdi at end-expiration, 2.6 mm;  $\Delta$ tdi% of 88.4%). Thus, paradoxical breathing was assumed to be due to high respiratory load that was triggered by severe asthma attack.



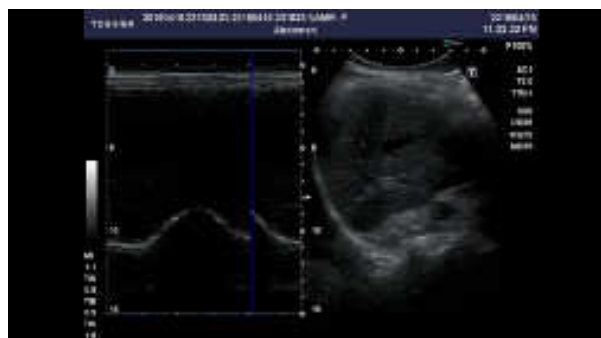
**Figure 1:** Diaphragm ultrasonography reveals that right diaphragm contracts normally (thickness of diaphragm [tdi]; Figure 1A: tdi at end-inspiration, 4.9 mm; Figure 1B: tdi at end-expiration, 2.6 mm;  $\Delta$ tdi% of 88.4%).



**Video 1:** Paradoxical breathing with the chest wall moving inwards during inspiration and outwards during expiration.



**Video 2:** Audiograph of Grade 3 wheezes during 10 seconds. Pink line shows continuous lung sounds covering a wide range of high pitch (>200 Hz) both in inspiratory and expiratory phases.



**Video 3:** Diaphragm ultrasonography with B-mode and M-mode at the zone of apposition (ZOA): Note both modes revealed high-echoic diaphragm dome moving well with the respiratory cycle.



**Video 4:** Pulsus paradoxus.

**Note:** To best view

1. Kindly open the pdf file in Adobe Reader XI version.
2. Please save the pdf file on your local computer.
3. To watch the video kindly install the latest adobe flash player. Click here to download: <http://get.adobe.com/flashplayer/otherversions/>

Her condition worsened despite the aggressive therapy with intravenous methylprednisolone and albuterol by nebulizer and pulsus paradoxus (30 mmHg:210/180) was observed on day 5 of hospitalization (Video 4). However, her condition improved over the following 2 days without additional treatment, and she was discharged on day 14. Later, the bronchodilator reversibility test was performed with the positive result supporting the diagnosis of asthma.

In summary, this case illuminates the importance of diaphragm ultrasonography as a tool to assess paradoxical breathing; moreover, it revealed that the paradoxical breathing observed in the patient was not associated with diaphragm dysfunction. In general, paradoxical breathing suggests diaphragm dysfunction or other respiratory muscle fatigue.<sup>1,2</sup> However, Tobin et al reported that this could be observed because of an increased respiratory load rather than muscle fatigue.<sup>3</sup> In our case, diaphragm ultrasonography revealed that paradoxical breathing is without diaphragm dysfunction. Therefore, we assume that it was due to increased respiratory load that was triggered by severe asthma attack.<sup>2,3</sup>

#### CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

#### CONSENT

The authors obtain written informed consent from the patient for submission of this manuscript for publication.

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