Internal Medicine
The Japanese Society of Internal Medicine
doi: 10.2169/internalmedicine.0623-17
Intern Med 58: 423-425, 2019
http://internmed.jp

【 CASE REPORT 】

# Answer Found in a Blowing Sound: Amphoric Breathing Due to Cyst Formation in Pulmonary Adenocarcinoma

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**Abstract:**
A 51-year-old woman presented with dyspnea that had progressed over the previous year. On a physical examination, harsh, hollow breath sounds with a high-pitched timbre, termed "amphoric breathing", were identified during inspiration and expiration. Chest radiography and thoracic computed tomography performed over the previous three years revealed an enlarging cyst in the right lung arising from an area of consolidation. Pulmonary adenocarcinoma (T4 N0 M1a, stage IV) was diagnosed and considered a possible cause of the cyst, resulting in amphoric breathing.

**Key words:** amphoric breathing, auscultation, breath sounds, pulmonary adenocarcinoma, cyst, air trapping

**(Intern Med 58: 423-425, 2019)**
**(DOI: 10.2169/internalmedicine.0623-17)**

## Introduction

Amphoric breathing, also termed cavernous breathing, is an indication of a cavity, cyst, bleb, or other air-containing space in the lung communicating with the bronchial system. Amphoric breathing resembles tracheal breathing in that the inspiratory and expiratory phases are much closer to each other in amplitude and duration than is the case with normal vesicular breathing. However, amphoric breathing has a more resonant and harmonious timbre with lower frequencies more amplified than in tracheal breathing, and it can be heard where vesicular breath sounds are expected (1, 2). Cavities with relatively rigid and inflexible walls produce the best amphoric breath sounds (1). Due to a poor understanding of its significance, the importance of amphoric breathing is likely to be underestimated in general practice.

In the present case report, we describe a patient with amphoric breathing who was found to have pulmonary adenocarcinoma that had developed a large cyst within an area of consolidation.

## Case Report

A 51-year-old woman was referred to our hospital with dyspnea that had progressed over the preceding year. She was an ex-smoker with a 10-pack-year history. She had no history of dust exposure or illicit drug use. Her thoracic movement and vital signs were normal except for fine crackles over the posterior left lower lung fields (Supplementary material 1) and harsh breath sounds over the right middle to lower lung fields posteriorly (Supplementary material 2), with hyperresonance to percussion. This blowing sound resembled tracheal breathing but had a more resonant quality and harmonious timbre. The blowing sound, hereafter referred to as amphoric breathing, was heard equally in both the inspiratory and expiratory phases (1).

Chest radiography performed three years prior to this presentation showed a dense infiltrate in the right lower lung field (Fig. 1A) that was further confirmed by the thoracic computed tomography (CT) finding of consolidation with bronchial dilatation (Fig. 1E). A chest radiograph (Fig. 1B) and thoracic CT (Fig. 1F) taken 1 year later demonstrated an expansion of the dense infiltrate in the right lower lung field, in which a newly recognized cyst had developed,

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Received for publication December 3, 2017; Accepted for publication July 16, 2018
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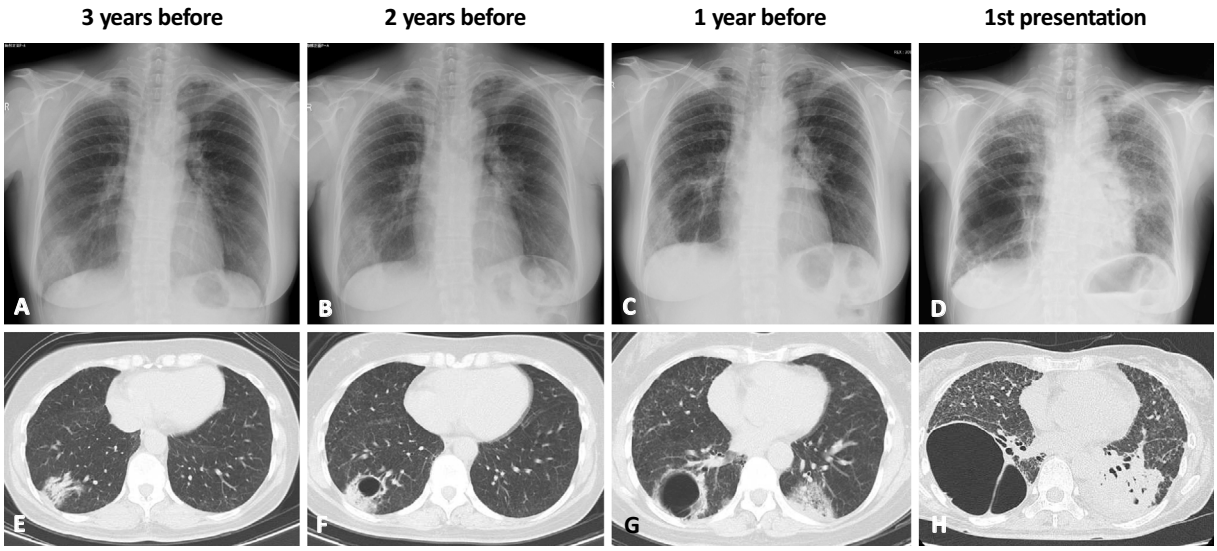


**Figure 1.** **A chest radiograph taken three years prior to presentation shows dense infiltrate in the right lower lung fields (A), and consolidation with bronchial dilatation in the right lower lobes (E) was confirmed on thoracic computed tomography (CT). One year later, the consolidation progressed (B), and a 2-cm cystic lesion had appeared (F). Chest radiography and thoracic CT obtained 1 year prior to visiting our hospital showed expansion of the cyst to 4 cm in size (C, G). Chest radiograph taken on the first visit to our hospital demonstrated a 7-cm cyst in the right hemithorax (D) that was found to occupy the right lower lung lobe on thoracic CT (H).**

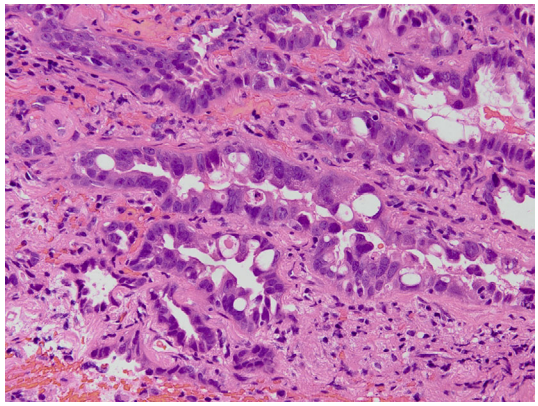

**Figure 2.** **Hematoxylin and Eosin staining of biopsy specimens obtained from the left lower lobe showed acinar proliferation of cuboidal cancer cells, suggesting pulmonary adenocarcinoma.**

measuring 2 cm in size. A chest radiograph (Fig. 1C) and thoracic CT (Fig. 1G) taken 1 year prior to this presentation revealed that the cyst had grown to 4 cm in size. Finally, a chest radiograph (Fig. 1D) and thoracic CT (Fig. 1H) taken at her first visit to our hospital demonstrated a large cyst in the right lower lung measuring 7 cm in size. The images also showed generalized tiny nodules in both lungs, with consolidation in the left lower lung (Fig. 1D, H).

Hematoxylin and eosin staining of transbronchial biopsy specimens obtained from the left lower lung field showed well-differentiated atypical cuboidal cells with an acinar pattern of growth (Fig. 2). No metastatic lesions were found outside the lung on positron emission tomography/CT, so pulmonary adenocarcinoma (T4 N0 M1a, stage IV) was diagnosed. The tumor cells were found to be negative for epidermal growth factor receptors and anaplastic lymphoma kinase but positive for programmed death-ligand 1, with a tumor proportion score of 5%. The patient was therefore treated with three courses of carboplatin and nab-paclitaxel, followed by pembrolizumab as a second treatment. However, the tumor was refractory to chemotherapy, so she was transferred to another hospital for palliative care. Her amphoric breathing could be heard throughout the hospitalization period.

## Discussion

The present case demonstrated the rare finding of amphoric breathing. The presence of the typical blowing sound suggests turbulent flow in a cavity or cyst opening into the bronchus. The sound resembles tracheal breathing but is more hollow and resonant, with a harmonious timbre heard in both the inspiratory and expiratory phases. As in the present case, the breathing is heard where vesicular breath sounds are expected (1).

The pathophysiology of amphoric breathing due to the large cyst in this case was not clear. Potential mechanisms included ischemic necrosis of the central area of the cyst/cavity or traction ectasia of the thickened wall, along with increasing size of the cavity itself. However, air trapping via bronchial obstruction by a tumor is another possible cause. Because the large cyst in the right lower lung gradually enlarged without generating necrotic tissue on thoracic CT, the clinical course, along with the increasing number of tiny

nodules, suggested the progression of lung adenocarcinoma.

We previously reported a unique case of cyst formation in the lung that might have been caused by the development of bronchial obstruction over a short time (3) and another case that had multiple lung cysts due to *Pneumocystis jirovecii* pneumonia, with complete resolution after treatment (4), suggesting a check-valve mechanism.

The stethoscope was invented by French physician Rene Laennec in 1816 (5), but in 21st-century medicine, its value for general physicians is not always appreciated (6). However, the present case demonstrated the importance of auscultation in the consideration of the pathophysiology of cyst formation in a clinical context. Indeed, Laennec himself described the concept of "pectoriloquy", a loud whispering heard over areas of lung cavitation (7). When associated with a blowing sound, this is commonly referred to today as amphoric breathing.

Even in the modern era, auscultation can be an essential tool for making a diagnosis (8). This case reminds us that amphoric breathing is strongly suggestive of a cavity or cyst opening into the bronchus, including the possibility of air trapping in the lung, caused by a check-valve mechanism.

**The authors state that they have no Conflict of Interest (COI).**

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