Received: 27 February 2024 | Revised: 17 June 2024 | Accepted: 1 July 2024

DOI: 10.1002/jgf2.717

Journal of General and Family Medicine Open Access WILEY

CASE REPORT

Computed tomography findings of 50 patients diagnosed with aspiration pneumonia: A case series

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Funding information
Japan Society for the Promotion of Science (JSPS) KAKENHI, Grant/Award Number: JP21K10251

Abstract

The effect of neglecting imaging in aspiration pneumonia diagnosis is not well understood. In this study, the computed tomography images of 50 patients diagnosed with aspiration pneumonia were retrospectively analyzed by three radiologists at a different hospital. Among these cases, 32%–42% were not classified as aspiration pneumonia based on imaging. Thus, imaging features may not have been adequately considered for diagnosing aspiration pneumonia. Although not all patients with aspiration pneumonia can be diagnosed based on imaging, aspiration pneumonia should be considered in the diagnosis as cases that are clearly nonaspiration pneumonia can be misdiagnosed as aspiration pneumonia.

KEYWORDS
aspiration pneumonia, diagnostic criteria, imaging features, incorrect diagnosis

1 | BACKGROUND

The mortality rate associated with pneumonia, including aspiration pneumonia (AP), is high among individuals in the hyper-aged society of Japan; thus, preventing this disease is critical. In Japan, AP accounts for a high proportion of pneumonia cases, with the Japanese Respiratory Society[1] reporting that >60% of patients hospitalized for community-acquired pneumonia have AP.[2] Other studies[3–5] have reported that 42.1%–46.7% of patients with pneumonia requiring hospitalization have AP. The rate of AP is significantly higher in Japan than in European and other Asian countries.

We reviewed the diagnostic criteria for AP in Japan[6] and observed that imaging features are described in only 12 of the 58 references, suggesting that diagnosis without analyzing imaging features contributes to the higher incidence of AP in Japan than in Western countries. Komiya et al. analyzed chest computed tomography (CT) findings of patients diagnosed with AP and reported diverse imaging features. Nonetheless, some common findings were observed, including dorsally predominant distribution in 92% of the cases and bronchopneumonia in 68%.[7] Thus, the accuracy of AP diagnosis may be improved by considering imaging features.

As guidelines stating "most pneumonia in the elderly is aspiration-related[1]" are widely used in clinical practice, AP may frequently be diagnosed in older patients without assessing imaging features. This may affect the patient's initial response to treatment and subsequent administration of oral therapeutics. Comprehensive studies that specifically examine the impact of neglecting imaging features on AP diagnosis in the older population are limited. Therefore, here, we

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retrospectively analyzed the chest CT images of patients diagnosed with AP to assess the role of imaging in the diagnoses of these cases.

2 | CASE PRESENTATION

In this retrospective case series, procedures adhered to laws and institutional guidelines. The appropriate ethics committee waived the need for approval and informed consent for this review of medical records.

2.1 | Participants

Overall, 82 patients were diagnosed with AP at other hospitals, and they improved with treatment but were transferred to our hospital (97-bed community hospital) between April 2014 and March 2020 for continued inpatient care owing to a decline in activities of daily living and other factors. Of these, 50 patients with CT images obtained at other hospitals during diagnosis were included in this study (Table 1).

2.2 | Evaluation of CT findings

Three radiologists, blinded to patient details, reviewed the CT images of 50 patients and classified the findings into five groups based on "reading rules" (Table 2). We originally developed these "reading rules" using Reporting and Data Systems for radiological image evaluation. Specifically, we referred to the COVID-19 Reporting and Data System from the Dutch Radiological Society to assess lung CT images in patients suspected of coronavirus disease.[8]

2.3 | Statistical analyses

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 27 (IBM Corp., Armonk, NY, USA). Interrater reliability was defined using intraclass correlation coefficients.

TABLE 1 Patient characteristics.

Total	50
Gender (male)	29 (58)
Age (years)	86.2 (82.8–91.0)
Underlying disease	
Dementia	31 (62)
Post-stroke	13 (26)
Parkinson's disease	3 (6)
Other[a]	3 (6)

Note: Data are presented as numbers (%) or medians (interquartile range).

[a]Depression, chronic heart failure, and chronic obstructive pulmonary disease.

3 | RESULTS

The radiologists assigned the highest and lowest number of cases to Groups 5 and 1, respectively, with varied judgments (Table 2). One-way analysis of variance for intraclass correlation coefficients (0.703) indicated good reliability. Over 30% of the cases (Groups 1–3) were interpreted as non-AP (32%–42%).

4 | DISCUSSION

Komiya et al. reported that CT scans of patients with AP frequently present with a bronchopneumonia pattern and a gravity-dependent distribution.[7] AP is commonly diagnosed based on new infiltrates observed on CT images in gravity-dependent lung segments.[9] Here, among patients diagnosed with AP, only 34%–56% had typical AP features on CT images (Group 5); 12%–28% of patients had suspected AP on CT images without typical features (Group 4). These patients may have been diagnosed with AP based on clinical findings, including swallowing function. However, 32%–42% were considered to have pneumonia but not AP (Group 3), an abnormality that may or may not be pneumonia (Group 2), or no findings of pneumonia (Group 1) on imaging. Thus, imaging features are not sufficiently considered in AP diagnosis.

The most widely used diagnostic criterion for AP in Japan is "when pneumonia occurs in a patient who has aspiration or a condition predisposing to aspiration"; this does not account for the radiographic features of pneumonia. The high sensitivity of this criterion was set to ensure that all possible AP cases were diagnosed. However, it has led to misdiagnosis of pneumonia and other conditions, including AP. Although not all AP cases can be diagnosed by assessing imaging features, including imaging features in the diagnostic criteria may improve the accuracy. Distinguishing AP from non-AP can avoid unnecessary dietary restrictions.[6] A systematic review revealed that AP increases mortality by approximately 3.5 times during and after hospitalization,[10] emphasizing the importance of accurate diagnosis for prognostic prediction. Owing to radiation exposure and cost concerns, uniform CT scans for all suspected pneumonia cases are not recommended. Therefore, imaging should be selectively used based on a careful evaluation of its benefits and risks. When CT scans are obtained, they should be interpreted correctly, considering the AP imaging features.

This study had some limitations. The basis for AP diagnosis in each of the 50 cases was not clarified, introducing potential selection bias and limiting generalizability. As a retrospective single-center study, a prospective multicenter study is needed for validation. Additionally, the classification in Table 2 is original and not yet independently verified. Because of the novel nature of our research, existing classifications were insufficient, necessitating the development of this new classification based on Reporting and Data Systems for radiological image evaluation.

TABLE 2 Reading rules and evaluation results.

	Level of suspicion of aspiration pneumonia	Imaging diagnosis (imaging features)	Radiologist #1	Radiologist #2	Radiologist #3
5	Very high	Aspiration pneumonia (bilateral and dorsal predominant shadows and soft endotracheal and bronchial shadows, among others)	18	28	17
4	High	Pneumonia not definitively diagnosed as aspiration pneumonia (nontypical aspiration pneumonia and aspiration pneumonitis, among others)	11	6	14
3	Equivocal/Unsure	Pneumonia but not aspiration pneumonia (common bacterial pneumonia, pulmonary nontuberculous mycobacterial antimycobacteriosis, and interstitial pneumonia, among others)	11	6	8
2	Low	Abnormality: unsure if pneumonia (old pulmonary tuberculosis, inflammatory scar, atelectasis, collapsed lung, pulmonary edema, and lung tumor, among others)	7	8	8
1	Very low	No finding of pneumonia (almost no abnormality on the image)	3	2	3
Total			50	50	50

5 | CONCLUSION

Overall, 32%–42% of cases originally diagnosed as AP were not classified as AP after a review of the CT imaging features. Thus, imaging features are not adequately considered for AP diagnosis. Our findings highlight a crucial issue in AP and suggest the importance of the widespread use of diagnostic methods that incorporate imaging features.

AUTHOR CONTRIBUTIONS

All authors meet the ICMJE authorship criteria. AU made substantial contributions to study conception and data acquisition, analysis, and interpretation. KNo made significant contributions to supervision, drafting the manuscript, and revising the manuscript critically for important intellectual content. NF made contributions to the review and editing of the manuscript. KNa, YM, and YI made contributions to the investigation. All authors have approved the submitted version of the manuscript and agree to be accountable for any part of the work.

ACKNOWLEDGMENTS

We would like to thank Editage (www.editage.com) for English language editing.

FUNDING INFORMATION

This work was supported by Japan Society for the Promotion of Science (JSPS) KAKENHI (grant number: JP21K10251). The funder had a role in the proofreading, printing, and reproduction of this manuscript. The funder had no role in the study design; in the collection, analysis, or interpretation of data; or in the decision to submit the article for publication.

CONFLICT OF INTEREST STATEMENT

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

DATA AVAILABILITY STATEMENT

The data used in this study cannot be made publicly available because of personal data protection laws and respect for patient privacy. However, the key results and analytical methods are detailed in the paper, providing all necessary information to understand the research.

ETHICS STATEMENT

Ethics approval statement: All procedures in this study adhered to the appropriate laws and institutional guidelines. Because of the retrospective nature of this case series, the ethics committee of the Japan Association of Healthcare Institute waived the need for approval and informed consent for the review of medical records (JAHI23-02).

Patient consent statement: None.

Clinical trial registration: None.

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How to cite this article: Ueda A, Nohara K, Fujii N, Nakajima K, Miyauchi Y, Inoue Y. Computed tomography findings of 50 patients diagnosed with aspiration pneumonia: A case series. J Gen Fam Med. 2024;25:384–387. https://doi.org/10.1002/jgf2.717