

# Hair-elastic Bead Artifact Demonstrating the Radiographic Appearance of a Single Pulmonary Nodule

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## Abstract

A solitary pulmonary nodule was identified radiographically in a 61 year-old female smoker complaining of dyspnea. Solitary pulmonary nodule (SPN) is a single nodular opacity on chest imaging, which may indicate malignancy. Workup of this finding may require initial evaluation by CT scan, subsequent multiple follow up scans, and may ultimately warrant surgical biopsy for tissue diagnosis. False positive diagnosis of SPN may result in unnecessary radiation exposure, patient anxiety, and resource use that could be avoided by careful consideration of the clinical picture. Here we present a case of a false positive SPN attributable to hair-elastic bead artifact. Hair artifact is a rare and avoidable phenomenon in which a patient's hair is visualized on chest imaging, causing focal opacification not attributable to lung pathology. Hair-elastic bead artifact has previously not been described. We report it as the phenomenon of a bead on a hair-elastic with the radiographic appearance of focal opacification. Clinicians should be conscious of hair and hair-elastic bead artifacts before other initiating next steps in a workup.

## Introduction

A solitary pulmonary nodule (SPN) is an intra-parenchymal lung lesion without associated atelectasis or adenopathy. SPN is a common radiographic finding, present in up to 3.5% of all chest radiographs.<sup>1,2</sup> While a broad differential diagnosis exists for this finding, including malignancy and granulomatous disease, the incidence of malignancy in SPN has been reported from 10-68% depending on patient characteristics and the size of the lesion.<sup>1,3,4</sup> In the event that SPN is malignant, early resection is favourable, as 5-year survival post-resection of bronchogenic carcinoma is up to 80%.<sup>4</sup>

Misidentification of an SPN on initial imaging may expose patients to unnecessary radiation. Few cases exist in the literature in which an artifact present as a false positive SPN, though these cases remind clinicians of the importance of clinically correlating incidental radiographic findings. Here we present a case in which an external foreign body had the radiographic appearance of SPN.

## Case Report

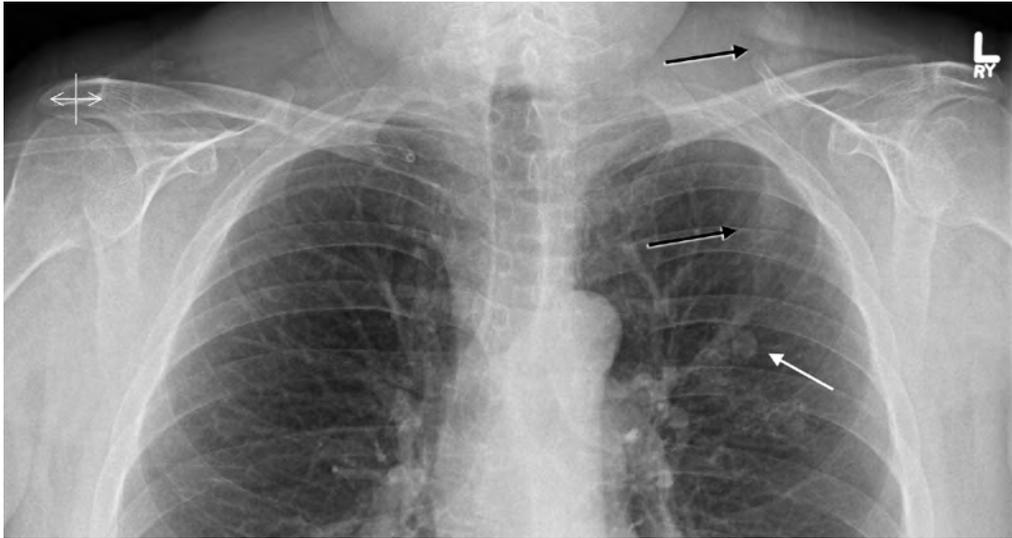
A 61 year-old female smoker, presented with four days of worsening dyspnea not responsive to supplemental oxygen. This patient had a prior history of giant cell tumor of the wrist, a usually benign tumor that has the potential to metastasize to the lung (1-6%) and undergo malignant transformation (less than 1%).<sup>5</sup>

Chest radiography revealed a 1 cm diameter, well demarcated nodular opacity in the left mid-upper lung (Figure 1), with no associated cavitation, or calcification. A poorly demarcated, wedge-shaped opacity was seen superior and medial to the nodule. The remainder of the radiograph was unremarkable.

Comparison to a study taken one month prior did not have evidence of this left lung nodule (Figure 2). No other interval change was remarkable. The rapid development of a new pulmonary lesion was determined to be unlikely, given the expected natural history of pulmonary malignancy.

On realizing this discrepancy between such a recent comparison study, alternative explanations were considered.

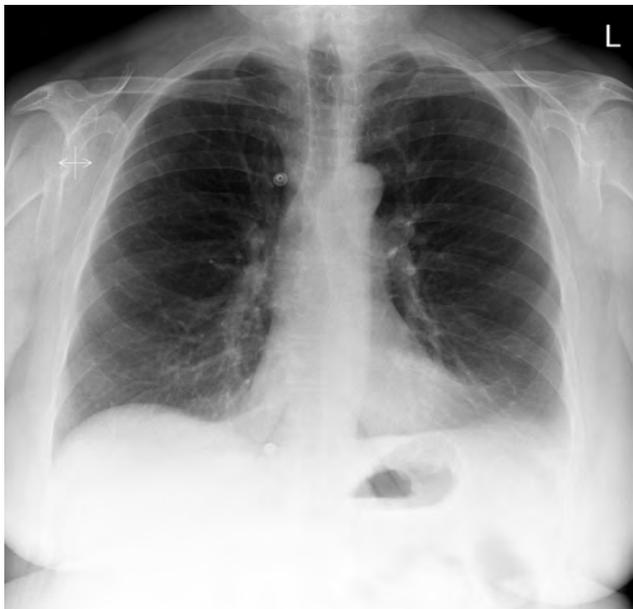
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**Figure 1.** Initial chest radiograph demonstrating SPN. A well-demarcated nodular opacity 10 mm in diameter is well visualized in the left mid-upper lung (white arrow). An oblique, wedge-shaped opacity (black arrows) extends superiorly from this nodule. No other pathology is visualized.

The close proximity of the apparent nodule with the wedge-shaped opacity, as well as the subtle appearance that this opacification extends outside of the pleura was suggestive of an extra-pulmonary feature, most consistent with a hair artifact. Physical exam of the patient demonstrated a braided ponytail with a beaded hair-elastic (Figure 3).

Repeat imaging demonstrated normal lung pathology, and confirmed that the SPN was caused by this extracorporeal foreign body (Figure 4).



**Figure 2.** Comparison studies with no SPN. Comparison view of the patient taken one month prior to presentation. No nodular opacifications are observed. Subtle nonspecific blunting of the left costophrenic angle was noted.

## Discussion

The differential diagnosis of SPN includes nonspecific inflammatory nodule, infectious granuloma secondary to tuberculosis or fungal infection, pulmonary hamartoma, abscess, arteriovenous malformation, congenital lesions including bronchogenic cysts, primary lung malignancy, and lung metastases.<sup>3</sup> This patient also had a wedge-shaped peripheral opacity in the left upper lung, which may have been suggestive of pneumonia, segmental atelectasis, or pulmonary embolism with a Hampton's hump sign.



**Figure 3.** External foreign body identified on exam. The patient's hair was braided in a long ponytail, which was held together with a beaded hair-elastic, mimicking a solitary pulmonary nodule on the chest radiograph. Particular attention should be paid to the bead on the patient's hair-elastic, which resembles an SPN radiologically.

Identification of a SPN on chest X-ray typically merits further imaging on CT, because of the high incidence of malignancy and the favourable expected outcome with early resection of pulmonary neoplasia. Radiographic characterization of SPN is the mainstay of diagnosis and prognostication, with computed tomography (CT) as the imaging modality of choice. CT has a higher specificity and sensitivity for SPN as it allows for high-resolution characterization of the nodule's size, border characteristics, and density, as well as characterization of superimposed structures.<sup>3,4</sup> Lesion diameter is predictive of cancer, with a linear correlation between size and prevalence of malignancy.<sup>3,4</sup> Irregular, lobulated, and spiculated borders are similarly associated with an increased risk of malignancy in SPN. The presence of either internal dense or popcorn calcification, or a fatty component of the SPN are reassuring features associated with benign lesions.<sup>3</sup>

The workup algorithm of SPN depends on CT characterization: lesions greater than 8mm with low clinical risk of cancer require repeat CT scan annually for at least 2 years; lesions greater than 8mm with a clinical suspicion of malignancy warrant at least FDG-PET, invasive biopsy with mediastinal lymph node sampling, and radiographic surveillance.<sup>3,6</sup> The subsequent workup of SPN exposes patients to additional radiation, and may require invasive procedures for tissue collection and pathologic diagnosis. In a study of patients with SPN identified on chest x-ray, greater than 70% required additional investigation with a mean cumulative addition dose of 10 mSv.<sup>2</sup> It is imperative that initial

radiologic diagnosis of SPN be certain to avoid exposing patients to radiation unnecessarily.

In this case, hair-elastic bead artifact with a foreign body resembled SPN in a patient at high risk for lung malignancy. Hair-elastic bead artifact, in which a beaded hair-elastic is visualized on chest imaging produces a false positive for SPN, is not well reported in the literature. Hair artifact has been described in three cases in which braided hair has been confused for lung pathology.<sup>7,9</sup> The phenomenon is rarely observed because most technician protocols require hair and non-essential foreign bodies be positioned outside of the image frame. Reports of hair artifact have traditionally come from dental radiology and emergency department imaging of uncooperative patients; both of these scenarios make it more difficult for technicians to remove obscuring hair.<sup>8</sup> In this case, the presence of hair artifact reduced the suspicion of malignancy and signaled an alternate cause of the nodular opacity: hair-elastic bead artifact.

The pre-test suspicion of lung malignancy was high for this patient, an elderly smoker presenting with dyspnea and with a prior history of bone neoplasm.<sup>3</sup> A new lung malignancy could have explained the patient's dyspnea had it represented decompensation from an impaired baseline, however a malignancy would not be expected to develop in the one-month interval between available imaging. The identification of a nodular pulmonary opacity nearly initiated a series of unnecessary testing and radiation exposure were it not for consideration of the natural history of malignancy, a correlation to physical exam, and an awareness of hair artifact. It is important that radiologists and clinicians consider potential false positives, especially when the diagnosis would initiate an extensive subsequent workup.



**Figure 4.** Repeat imaging demonstrates no lesion. Repeat imaging after the patients hair had been positioned outside of the image frame demonstrates no true pulmonary nodule. No hair artifact or hair-elastic head artifact are visualized overlying the lung. A braid of hair is visualized above the left shoulder (white arrow). No acute lung or mediastinal pathology was identified.

## References

1. Ost D, Fein A. Evaluation and management of the solitary pulmonary nodule. *Am J Respir Crit Care Med* 2000; 162(3 Pt 1):782-7.
2. Lumberras B, Vilar J, González-Álvarez I, Gómez-Sáez N, Domingo ML, Lorente MF, et al. The Fate of Patients with Solitary Pulmonary Nodules: Clinical Management and Radiation Exposure Associated. Coleman WB, editor. *PLoS ONE* 2016;11(7):e0158458-14.
3. Albert RH, Russell JJ. Evaluation of the solitary pulmonary nodule. *Am Fam Physician* 2009;80(8):827-31.
4. Ost DE, Gould MK. Decision Making in Patients with Pulmonary Nodules. *Am J Respir Crit Care Med* 2012;185(4):363-72.
5. Chakarun CJ, Forrester DM, Gottsegen CJ, Patel DB, White EA, Matcuk GR Jr. Giant Cell Tumor of Bone: Review, Mimics, and New Developments in Treatment. *RadioGraphics* 2013;33(1):197-211.
6. MacMahon H, Austin J, Gamsu G, Herold CJ. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society 1. *Radiology*; 2005.
7. Buccini RV, Rubin IL. Radiographic artifact from braided hair mimicking tuberculosis. *N Engl J Med* 1985;313(19):1227-8.
8. Genes N, Lupow J. Images in emergency medicine. Hair artifact. *YMEM* 2009;53(4):545-73.
9. LaBelle VS, Spock A. Hair artifacts that may simulate disease. *N C Med J* 1992;53(4):170-1.