Case Report

Cicatricial Organizing Pneumonia with Dendriform Pulmonary Ossification: An Unusual Cause for a Recurrent Pneumothorax

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Cicatricial organizing pneumonia is an uncommon form of organizing pneumonia, which may manifest as persisting linear opacities on computerized tomography (CT) scan mimicking a fibrosing interstitial pneumonia. It may also manifest with pulmonary ossification, which is a metaplastic bone formation within the lung tissue. The latter presentation could be either nodular or dendriform, both secondary to underlying lung disease and rarely idiopathic. Dendriform pulmonary ossification (DPO) has rarely been described as a cause of spontaneous pneumothorax. We present a case of a 55-year-old male with history of recurrent pneumothoraces and worsening dyspnea on exertion. A CT of the chest revealed progressive bilateral sub-pleural and peribronchovascular reticular opacities associated with densely ossified branching and nodular opacities. Video-assisted thoracoscopic biopsy of the lung demonstrated cicatricial organizing pneumonia with areas of marked diffuse DPO. The case highlights that dendriform pulmonary ossification arising from cicatricial organizing pneumonia should be considered in the differential diagnosis of recurrent pneumonias among patients with lower lobe sub-pleural reticular opacities. The case highlights that dendriform pulmonary ossification rarely can cause spontaneous pneumothorax and can be associated with cicatricial organizing pneumonia and reticular opacities on imaging.

1. Introduction

Organizing pneumonia (OP) is characterized by the presence of organizing fibromyxoid proliferations within the lumens of respiratory bronchioles and alveolar ducts. Peripheral and/or peribronchiolar consolidations are the most frequent findings of OP on a computerized tomography (CT) scan. These opacities could be migratory in nature. OP is often steroid-responsive and reversible with total resolution of radiological opacities, but occasionally may recur [1, 2].

Cicatricial OP (OPc) is a newly described entity in the pathology literature [3, 4] and distinguished from conventional OP by formation of irreversible dense fibrous bands and small nodules in the background of conventional OP [4]. The reported CT findings of OPc are variable and range from typical imaging findings of OP to lower lobes predominant peribronchovascular and sub-pleural reticular opacities with or without pulmonary ossification [4]. The latter is characterized by metaplastic ossification in the lung and is classified into nodular (NPO) and dendriform (DPO) subtypes [5]. Dendriform pulmonary ossification is usually described in association with chronic lung disease including usual interstitial pneumonia (UIP) [5, 6] although it can be seen in isolation [7, 8]. Dendriform pulmonary ossification presenting with spontaneous pneumothorax has been reported in a few occasions [9–14] but rarely with OPc [4]. We report a case of cicatricial organizing pneumonia with DPO who presented with recurrent pneumothorax. The clinical, radiological and pathological findings as well as the pulmonary functions have been described.

2. Case Report

A 55 year-old, nonsmoker male presented with a recurrent large left pneumothorax requiring a chest tube placement. He had a same side pneumothorax three and six years earlier, also requiring a chest tube placement. The patient also reported
dyspnea on exertion with stairs and inclines, which had progres-
ssed over last three years along with a dry cough.

He had a remote exposure to quails while training hunting
dogs. He was known to have hypertension and suffered with
symptoms of gastroesophageal reflux disorder (GERD). His
physical examination was unremarkable. A review of his pul-
monary function revealed gradual decline in his FEV1, FVC and
diffusion capacity over the past seven years (Table 1).

Review of serial chest CT imaging revealed progressive
bilateral sub-pleural and peribronchovascular branching
dense opacities suggestive of DPO (Figure 1). He underwent
VATS wedge resection of the left upper and lower lobes, which
confirmed foci of dendriform ossification consisting of islands
of ossifying fibrosis (Figure 2). In addition, there were scat-
tered foci of OP, which, in some areas, had a more hyalinizing/
cicatricial type morphology consistent with OPc. Many of the
foci of DPO were associated with the OPc and showed tran-
sitions from conventional OP to OPc to the DPO (Figure 3).
Dendriform pulmonary ossification foci were present in the
subpleural region and occasionally adjacent to the visceral pleura
(Figure 4). Given these imaging and pathological find-
ings, the patient was diagnosed with DPO with cicatricial OP as
the likely cause of his dyspnea, recurrent spontaneous pneu-
mothoraces, and progressive restrictive impairment of lung
function. Since there is no established medical treatment, his

treatment plan was monitoring his symptoms and lung func-
tion and considering lung transplantation in case of
progression.

3. Discussion

Organizing pneumonia is usually steroid-responsive and
pathologically characterized by presence of loose fibromyxoid
plugs within the lumens of the respiratory bronchioles and
alveolar ducts [1, 2]. Cicatricial OP is distinguished from con-
tventional OP by formation of irreversible dense fibrous bands
and small nodules in a background of small or large foci of
conventional OP [4]. In OPc, fibromyxoid plugs as seen in OP
may be seen transitioning to more hyalinizing fibrous band/
nodule of cicatricial OP and into foci of ossification on imag-
ing as well as on pathology [4]. In our case, foci of DPO con-
sisting of islands of ossifying fibrosis were present throughout
both the left upper and lower lobes. In addition, there were
scattered foci of hyalinizing/cicatricial type organizing pneu-
omia [4], representing a more chronic form of organizing
pneumonia. Isolated focal plugs of hyalinized intra-alveolar
tissue can be incidentally seen on in lobar resections for unre-
lated primary indications and should not confused with OPc.
OPc tends to show bilateral and diffuse or patchy distribution
on imaging [3, 4]. Fibrosing OP is a different from OPc, though
it is not clearly determined what this pattern may represent.
It may be form of disease where the fibrous tissues cause
expansion of the alveolar septal interstitium such as in late
organizing stages of diffuse alveolar damage or fibrotic forms
of nonspecific interstitial pneumonia (NSIP) [3].

On CT, conventional OP presents as patchy bilateral peri-
bronchial and subpleural consolidations [15–19], which may be
migratory [20]. The classic “atoll” [20] or the “reverse
halo” sign [18] is only seen in 20% cases manifesting as
ground glass opacities with surrounding crescentic or ring-
shaped consolidation [21]. Perilobular opacities bordering
the periphery of the secondary pulmonary nodules are
observed [16, 19, 22] in more than half of OP cases.
Manifestations of OPc include ground glass opacities, often
associated with consolidations [15] and 1–10 mm nodular
opacities with consolidation [16, 17]. Less common imaging
features are subpleural or peribronchial irregular reticular
opacities with areas of consolidation [15, 16, 19] and large
nodules or mass-like consolidation [23]. Only 40% of the
reported OPc cases show typical imaging appearance and
other cases show variable nonspecific imaging findings
including peribronchial and peripheral reticular opacities
with or without evidence of pulmonary ossification [4].
Reticular opacities on CT imaging are seen in cicatricial OP
cases where fibrous bands and nodules are the predominant
feature on pathology with minor conventional OP. Presence
of branching high densities on CT is suggestive of dendri-
form pulmonary ossification.

Pulmonary ossification is a metaplastic process where
mature bone is present in the alveolar interstitium and/or alve-
olar spaces. Pulmonary ossification is classified into DPO and
NPO. NPO is usually a localized process of lamellar bone and
can occur in the setting of chronic congestion as seen in mitral
valve stenosis. Unlike DPO, NPO usually does not contain
bone marrow (fat or hematopoietic cells) [5]. On CT, NPO
manifests as lower lobe predominant small, often highly attenu-
ating, centrilobular nodules that may coalesce [24]. In DPO,

<table>
<thead>
<tr>
<th>Year</th>
<th>FEV1</th>
<th>Predicted %</th>
<th>FVC</th>
<th>Predicted %</th>
<th>FEV1/FVC %</th>
<th>DLco</th>
<th>Predicted %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>2.22</td>
<td>55%</td>
<td>3.01</td>
<td>57%</td>
<td>74</td>
<td>N/A</td>
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<tr>
<td>2017</td>
<td>2.62</td>
<td>69%</td>
<td>3.77</td>
<td>76%</td>
<td>70</td>
<td>20.74</td>
<td>68%</td>
</tr>
<tr>
<td>2015</td>
<td>2.96</td>
<td>76%</td>
<td>4.11</td>
<td>82%</td>
<td>72</td>
<td>24.76</td>
<td>80%</td>
</tr>
<tr>
<td>2014</td>
<td>3.15</td>
<td>81%</td>
<td>4.16</td>
<td>82%</td>
<td>76</td>
<td>24.76</td>
<td>80%</td>
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<tr>
<td>2013</td>
<td>3.41</td>
<td>87%</td>
<td>4.47</td>
<td>88%</td>
<td>76</td>
<td>23.61</td>
<td>76%</td>
</tr>
<tr>
<td>2012</td>
<td>3.39</td>
<td>85%</td>
<td>4.50</td>
<td>88%</td>
<td>75</td>
<td>32.39</td>
<td>103%</td>
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FVC: forced vital capacity, FEV1: forced expiratory volume in 1 second, DLCO: diffusing capacity of the lung for carbon monoxide (ml/min/mmHg), N/A: not available.
Axial chest CT images using lung (a), (c) and bone (b), (d) windows show bilateral branching dense nodular opacities (arrows) with mild associated reticulation. Some of the nodules are high in attenuation and almost iso-dense to ribs on bone windows. Axial images using lung window (e), (f) at the level of lung bases were obtained 5 years apart and show evidence of progression.

Large area of subpleural diffuse pulmonary ossification revealing lamellar bone with a more complicated pattern and areas of marrow elements including fat (arrowhead). Adjacent areas of cicatricial OP (arrows) are present (Hematoxylin and eosin; 12.5x).

Areas of OP (arrow) with adjacent foci of cicatricial OP transitioning to DPO (arrowhead) (Movat stain; 20x).
Spontaneous pneumothorax has been reported in several cases of DPO [9–14] including one case with cicatricial OP and DPO [4]. This case with cicatricial OP and DPO reported by Churg et al. [4] is likely the same case was reported by Tsai et al. [10]. In our case, foci of DPO were present in the subpleural areas, presumably causing recurrent pneumothoraces. It has been suggested that a subpleural sharp bony spicule may cause the pneumothorax by puncturing the visceral pleura [10, 13, 14]. None of the reported cases nor our case has other causes to explain the pneumothoraces, such as cystic or bullous lung disease, trauma, or bronchopleural fistula.

The case we present showed evidence of radiographic progression and worsening restrictive pattern on PFT over several years. The reported cases of cicatricial OP by Churg and his colleagues [4] have been suggested to be stable. However, almost half of those reported by Yousem [3] had persistent or progressive disease at a median of 110 months of follow-up. This may suggest that cicatricial OP is a spectrum and cases with minor conventional OP and predominant dense organization with fibrous bands and nodules may persist or even progress.

In summary, we present a case of cicatricial OP with DPO presenting with recurrent pneumothoraces and slow progressive pulmonary physiologic restrictive impairment. Cicatricial OP should be considered in the differential diagnosis of peribronchial or subpleural reticular opacities with DPO. Radiologists and clinicians alike should be aware of this newly described entity as distinct from other classical fibrosing processes, its potential association with DPO, and the presumed association between subpleural DPO and spontaneous pneumothorax.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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<table>
<thead>
<tr>
<th>Table 2: Differential diagnosis of pulmonary calcifications and ossifications.*</th>
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<tr>
<td><strong>Calcifications</strong></td>
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<tr>
<td>Dystrophic: calcifications in diseased lung</td>
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<tr>
<td>(1) Infections: granulomatous infection such as histoplasmosis and tuberculosis and viral infections such as varicella</td>
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<tr>
<td>(2) Granulomatous noninfectious disease: sarcoidosis</td>
</tr>
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<td>(3) Occupational lung disease: silicosis, coal workers’ pneumoconiosis</td>
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<td>(4) Metabolic lung diseases: amyloidosis, pulmonary alveolar microlithiasis</td>
</tr>
<tr>
<td>Metastatic: calcifications in normal lung</td>
</tr>
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<td>(1) Hypercalcemia in the setting of chronic renal failure, other causes of primary hyperparathyroidism, Paget’s disease, parathyroid carcinoma or multiple myeloma</td>
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<tr>
<td>Calcified metastasis</td>
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<tr>
<td>(1) Metastases such as mucinous carcinoma, chondrosarcoma and synovial sarcoma</td>
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<tr>
<th><strong>Ossifications</strong></th>
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<tbody>
<tr>
<td>NPO</td>
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<tr>
<td>In patients with chronic venous congestion such as long standing mitral stenosis</td>
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<tr>
<td>DPO</td>
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<tr>
<td>In patients with interstitial fibrosis</td>
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<tr>
<td>Bone forming neoplasms</td>
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<td>Osteogenic sarcoma metastasis</td>
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References


