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Exogenous lipoid pneumonia due to paraffin oil: the role of multidisciplinary discussion in diagnosis. A case series

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Abstract

Lipoid pneumonia (LP) is a rare interstitial lung disease caused by alveolar lipid accumulation. The exogenous form, due to chronic mineral oil exposure (particularly ingested liquid paraffin), is often underdiagnosed because of its heterogeneous clinical and radiological presentation. This case series (2020-2026) includes three men, all with chronic paraffin oil use for constipation. High-resolution computed tomography showed consolidations, ground-glass opacities, a crazy-paving pattern, and areas of fat attenuation [−52 to −119 Hounsfield units HU)]. Histopathological findings were consistent with LP in only one patient; in all cases, diagnosis was supported by multidisciplinary discussion (MDD). Paraffin oil was discontinued in all patients, and corticosteroids were given in two. Our case series highlighted that the MDD may serve as a helpful diagnostic clue in the appropriate clinical context; however, histopathological confirmation remains the reference standard when feasible.

Key words: lipoid pneumonia, exogenous lipoid pneumonia, paraffin oil, Hounsfield unit, biopsy, multidisciplinary discussion.

Introduction

Lipoid pneumonia (LP) is an uncommon phenotype of interstitial lung disease (ILD) caused by the accumulation of lipid material within the alveoli, resulting from a variety of inciting factors [1]. According to the current ILD classification, LP belongs to the group of alveolar filling patterns and is categorized into two distinct forms: endogenous and exogenous LP [2]. While endogenous LP is characterized by lipid accumulation within alveolar macrophages secondary to various pulmonary or metabolic conditions, such as airway obstruction, lung infections, pulmonary alveolar proteinosis, and lipid storage disorders, exogenous LP results from the introduction of external lipid substances into the lungs [3]. Similarly, aspiration of hydrocarbon compounds or smoke exposure (e.g., electronic cigarettes, vaping, fire gases) can provoke acute LP; on the other hand, repeated inhalation of mineral, vegetable, or animal oils are related to chronic forms [3-5]. Amid these compounds, the chronic use of liquid paraffin, also known as Vaseline oil, is widely used to relieve constipation and remains an underdiagnosed etiology [6]. Intra-alveolar retention of liquid paraffin may induce a chronic inflammatory response, leading to lipid organization, the formation of mass-like lesions, and, in advanced cases, the development of pulmonary fibrosis [3]. Radiological manifestations of LP on high-resolution computed tomography (HRCT) are heterogeneous and may overlap with those of other interstitial or inflammatory lung diseases [3,6]. Common findings include ground-glass opacities (GGOs), areas of consolidation, crazy-paving patterns, interlobular septal thickening, and centrilobular nodules; however, the presence of consolidations containing material with fat attenuation and negative Hounsfield unit (HU) values represents the most specific imaging feature for this condition [3,6]. Although the integration of clinical history, radiological findings, and, in selected cases, bronchoalveolar lavage (BAL) and histopathological examination is fundamental for the diagnosis of LP, the disease may be masked by surrounding inflammation or mimic malignancy and atypical infections, leading to delayed diagnosis or unnecessary invasive procedures [7]. In this scenario, multidisciplinary discussion (MDD) is central to integrating clinical, radiological, and, when available, pathological information to achieve an accurate diagnosis and guide appropriate patient management. Therefore, the purpose of this study is to present a case series of patients diagnosed with chronic exogenous LP secondary to habitual liquid paraffin use, highlighting that MDD plays a central role in integrating clinical history and distinctive HRCT findings to achieve an accurate diagnosis, and to guide the need for invasive procedures.

Materials and Methods

We performed a retrospective observational case series at the Regional Referral Center for Interstitial Lung Diseases and Sarcoidosis, Division of Respiratory Medicine, Policlinico Universitario "Paolo Giaccone", Palermo, Italy, from 2020 to 2026. Clinical records of three patients diagnosed with LP and followed at our institution were retrospectively reviewed. Demographic characteristics, clinical presentation, radiological findings, bronchoscopic and histopathological data (when available), therapeutic management, and clinical outcomes were collected and descriptively analyzed. The diagnosis of LP was established based on the integration of clinical history, radiological findings, and MDD, according to current diagnostic recommendations [2]. To contextualize the findings of our case series, a non-systematic search of the PubMed database was performed using the following keywords: "lipoid pneumonia", "exogenous lipoid pneumonia", "mineral oil", "computed tomography", and "diagnosis". This search was not intended as a systematic review, and no predefined inclusion or exclusion criteria were applied. Articles were selected by the authors based on their relevance to the epidemiology, pathophysiology, clinical presentation, diagnosis, and management of LP.

Case Series

Case #1

A 53-year-old man, former smoker (15 pack-years), with a history of paranoid schizophrenia and arterial hypertension, was referred to our ILD and Sarcoidosis Unit for persistent bilateral pulmonary abnormalities following hospitalization for influenza pneumonia complicated by acute respiratory failure. The patient reported no occupational or environmental exposure to potential inhaled antigens, including molds or birds as well as electronic cigarettes use or vaping. However, a detailed medical history revealed chronic oral ingestion of liquid paraffin (Vaseline oil) for longstanding refractory constipation. Serial HRCT scans showed persistent bilateral multifocal consolidations associated with extensive ground-glass opacities, interlobular septal thickening, and a crazy-paving pattern, predominantly involving the lower lobes, lingula, and middle lobe (Figure 1A-C). Some consolidations showed a pseudonodular appearance, while mediastinal lymphadenopathy remained stable over time. Due to the persistence of radiological abnormalities despite antibiotic therapy and systemic corticosteroids administered for suspected organizing pneumonia, the patient underwent two bronchoscopic evaluations. BAL cultures repeatedly isolated *Staphylococcus aureus*, whereas transbronchial biopsies (TBB) showed peribronchial fibrosis with chronic lymphohistiocytic

inflammation and rare multinucleated giant cells containing lipid-like material. 18F-fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) demonstrated mild-to-moderate metabolic uptake within the pulmonary consolidations, consistent with an inflammatory process. Pulmonary function tests (PFTs) revealed a mild restrictive ventilatory defect [forced vital capacity (FVC) 74% predicted; total lung capacity (TLC) 77% predicted] with a severely reduced diffusing capacity of the lung for carbon monoxide (DLCO 31% predicted).

The diagnosis of exogenous LP was established during the ILD MDD based on the history of chronic mineral oil exposure, the presence of intrapulmonary fat attenuation areas within pulmonary consolidations (mean attenuation value −119 HU) (Figure 1D), and TBB findings consistent with LP. Mineral oil intake was discontinued after gastroenterological evaluation, with replacement therapy for chronic constipation. Corticosteroid treatment was optimized. During follow-up, the patient showed clinical improvement, with reduced exertional dyspnea, stable pulmonary function, and normalization of resting oxygen saturation, despite persistent radiological abnormalities.

Case #2

An 81-year-old man, former smoker (20 pack-years), with a medical history of schizophrenia and type 2 diabetes mellitus, was referred to our ILD and Sarcoidosis Unit for the evaluation of persistent pulmonary consolidations suspected for malignancy or organizing pneumonia. He denied the use of electronic cigarettes or vaping products and reported no relevant occupational or environmental exposure to inhaled agents, including moulds or birds; only exposure to dog hair was reported. His medical history revealed prolonged oral intake of liquid paraffin for the treatment of chronic refractory constipation, which had been discontinued approximately one year before referral. The disease course began with the detection of a right middle–lower lung consolidation on chest radiography. Empirical antibiotic therapy with ceftriaxone was initiated; however, no radiological improvement was observed. Subsequent contrast-enhanced chest CT revealed a large consolidation involving the right middle lobe, characterized by attenuation values consistent with adipose tissue (mean attenuation value −102 HU), associated with abrupt interruption of the segmental bronchi. Additional bilateral parenchymal consolidations were also identified (Figure 2A-D).

Whole-body 18F-FDG PET/CT demonstrated mild hypermetabolic activity within the main consolidation [maximum standardized uptake value (SUVmax) 3.91], together with

heterogeneous uptake in bilateral pseudonodular consolidations surrounded by GGOs, findings suggestive of an inflammatory process rather than malignancy.

Flexible bronchoscopy with BAL was subsequently performed. Microbiological analyses were negative, while TBB showed mild peribronchial edema and a modest lymphoplasmacytic inflammatory infiltrate, without findings suggestive of LP. Given the marked radiological suspicion and the possibility of sampling error due to the limited representativeness of the biopsy specimen, the patient was referred to our ILD clinic for multidisciplinary assessment. Based on the combination of the characteristic radiological pattern, the history of prolonged liquid paraffin ingestion, and the exclusion of alternative diagnoses, exogenous LP was considered the most likely diagnosis. Oral corticosteroid therapy was initiated, and total avoidance of further mineral oil exposure was recommended.

At follow-up, the patient remained completely asymptomatic, without cough, dyspnea, fever, or respiratory exacerbations. Serial chest CT demonstrated a slight reduction in the size of the main right middle lobe consolidation, persistence of multiple bilateral low-attenuation consolidations, partial improvement of diffuse GGOs and crazy-paving pattern, and the appearance of new peribronchovascular pseudonodular opacities in the right upper lobe. Repeated BAL microbiological analyses remained negative, and additional laboratory investigations, including QuantiFERON-TB Gold testing and serum immunoglobulin levels, did not reveal significant abnormalities.

The case was subsequently discussed during the ILD MDD. The final diagnosis of exogenous LP secondary to chronic mineral oil aspiration was established through the integration of the typical CT findings, the relevant exposure history, the exclusion of infectious and immunological disorders, and the longitudinal clinical-radiological evolution. The diagnosis was discussed with the patient, and conservative management was recommended, consisting of continued avoidance of liquid paraffin exposure, gradual tapering of corticosteroid therapy, and close clinical and radiological surveillance.

Case #3

An 82-year-old man, never-smoker, with a medical history of arterial hypertension, chronic ischemic heart disease treated with coronary artery bypass grafting, prostate cancer previously treated with radiotherapy, and obstructive sleep apnea managed with nocturnal continuous positive airway pressure, was referred to our ILD and Sarcoidosis Unit for evaluation of persistent bilateral interstitial lung abnormalities incidentally detected during preoperative

investigations. His medical history was notable for occupational exposure, including previous employment at a shipyard with reported exposure to organic dust while using personal protective equipment. Furthermore, he had a history of chronic paraffin oil ingestion and long-term laxative use for the management of chronic constipation. During further exposure assessment, the patient also reported bird exposure and the use of cistern water, but denied domestic moulds exposure. The patient denied respiratory symptoms, including cough, dyspnea, fever, or weight loss. The HRCT scans performed between 2020 and 2025 demonstrated remarkably parenchymal abnormalities, characterized by multifocal GGOs, areas of consolidation, interlobular septal thickening, and a crazy-paving pattern. These findings predominantly involved the left lower lobe, with mild bronchiolectasis also observed within the affected areas, whereas no honeycombing was detected (Figure 2E and F). In particular, a zone of fat attenuation was identified in the left lower lobe on chest HRCT, with a mean attenuation value of −52 HU (Figure 2F). PFTs showed preserved lung volumes, with a forced expiratory volume in 1 second (FEV1) of 2.12 L (81% predicted), Forced Vital Capacity (FVC) of 2.97 L (84% predicted), and an FEV1/FVC ratio of 71%. Laboratory investigations, including inflammatory markers, were negative, and the patient denied symptoms suggestive of connective tissue disease. Physical examination revealed reduced vesicular breath sounds with fine "Velcro-like" crackles over the left lung base. According to the clinical history as well as the persistent and atypical radiological pattern, the case was discussed within the ILD MDD. Following a joint review of the exposure history and HRCT images by pulmonologists and thoracic radiologists, the imaging findings were considered highly suggestive of exogenous LP. Due to the absence of respiratory symptoms, the patient was managed with paraffin oil discontinuation, and clinical and radiological follow-up without initiation of any specific treatment (Table 1).

Discussion

LP represents an uncommon disease characterized by substantial clinical and radiological heterogeneity that may complicate the diagnostic pathway [7]. First described by Laughlen et al. in 1925, LP has historically been considered a rare entity; nevertheless, available autopsy data suggest that its prevalence may be underestimated [8]. Reported incidence ranges from 1.1% to 2.5% in autopsy series, increasing up to 8.8% among children, suggesting that the disease may be more frequent than clinically recognized and that a significant proportion of cases may remain undiagnosed due to its variable or asymptomatic presentation [3,8]. Our

case series highlighted several clinically relevant features that may facilitate LP diagnosis in routine practice. Despite its rarity, LP should be considered in patients presenting with compatible radiological abnormalities, particularly when a history of chronic mineral oil exposure is elicited. A diagnostic approach based on the MDD, detailed exposure assessment, HRCT evaluation, including Hounsfield unit (HU) measurements, may help guide the need for invasive procedures on an individual basis.

First of all, all patients reported a history of chronic paraffin oil exposure, although one patient had stopped its use approximately one year before referral. Paraffin oil is a liquid compound composed of saturated hydrocarbons that is derived from the refining of crude oil [9]. Particularly, it is widely used within the general population for its laxative effects, and several case reports have documented the development of exogenous LP following paraffin oil intake [5,10]. This oily compound is generally odorless and non-irritating; once aspirated, it can reach the distal airways where it is phagocytosed by alveolar macrophages. Since mineral oils cannot be effectively metabolized or cleared, they can accumulate within the alveoli, triggering a chronic foreign-body inflammatory reaction that may ultimately lead to fibrosis and persistent radiological abnormalities [9,10]. Nonetheless, mineral oil use is usually overlooked during routine clinical assessment because patients may not be aware of its relevance or may not spontaneously report its use. Therefore, a detailed anamnesis and targeted questions to identify the causative agent such as mineral oils or laxative use, followed by the avoidance of causative agent, is a key step in the management of exogenous LP. Additionally, two of our three patients were elderly (Cases 2 and 3) and two had a history of schizophrenia (Cases 1 and 2), which may have represented additional risk factors for paraffin oil inhalation. This finding is consistent with previous literature suggesting that advanced age, as well as psychiatric and neurological disorders, can impair swallowing function, thereby increasing the risk of paraffin oil microaspiration and potentially contributing to the development of LP [10]. To date, dedicated prospective studies quantifying this association and clarifying the underlying pathogenetic mechanisms are still scarce.

Regarding the diagnosis of LP, our case series highlights the central role of MDD in establishing a confident diagnosis through the integration of clinical history, exposure assessment, and HRCT findings in the diagnostic workup. Within the ILD field, the MDD is cornerstone of the diagnostic pathway due to the integration of clinical, radiological, and, when available histopathological data to achieve an accurate diagnosis, including rare diseases such as LP [2,11]. In our series, MDD was instrumental in recognizing the diagnostic relevance of chronic

oil exposure and interpreting the characteristic HRCT findings, including intrapulmonary fat attenuation, within the appropriate clinical context. Importantly, MDD allowed a confident working diagnosis even in the absence of definitive histopathological confirmation, which may support an individualized approach to invasive investigations.

In our case series, two of the three patients underwent TBB. In Case 1, the biopsy showed lipid-like material, consistent with the diagnosis of LP, whereas in Case 2, the findings were non-diagnostic, likely due to sampling limitations. Case 3 was diagnosed without any invasive procedure. Indeed, these findings further support the role of MDD in determining the need for invasive investigations on an individualised basis. Current literature suggests that both BAL and lung biopsy may provide supportive diagnostic information in LP but are not mandatory for diagnosis due to the potential risks associated with these invasive procedures [2]. In this scenario, MDD may function as a critical decision-making step, identifying patients in whom the combination of a compatible exposure history and characteristic HRCT findings are sufficient to achieve an adequate diagnostic yield. Within this framework, HRCT and quantitative assessment of attenuation values can be noteworthy components of the MDD. Although HRCT findings in LP can be heterogeneous and often associated with clinico-radiological mismatch, the detection of a compatible HRCT pattern along with intrapulmonary fat attenuation values within the range of –30 to –150 HU represents a highly suggestive radiological feature, particularly in patients with a compatible exposure history [2,9,12]. However, HU measurement should not be interpreted in isolation but rather incorporated into the broader clinical and multidisciplinary assessment. On the other hand, the detection rate of fat attenuation on chest HRCT can range from 40% to 80% even if its absence does not rule out LP diagnosis [12,13]. Specifically, the differences in HU values across our cases likely reflect the presence of inflammatory or fibrotic components which increase tissue density. Hence, attenuation measurements require technical considerations such as the accurate positioning of regions of interest into the most homogeneous portion of the consolidation, as well as individualized interpretation, given the influence of multiple technical and biological factors, including acquisition parameters, reconstruction algorithms, lesion composition, and concomitant inflammatory or fibrotic changes [14].

Additionally, even though all three cases were managed with discontinuation of paraffin oil exposure, only two patients received corticosteroid therapy. The role of corticosteroids in LP remains controversial; while some published case reports have described clinical improvement following their administration, no current guidelines support their routine use in this condition

[15,16]. Taken together, these findings suggest that a tailored approach to the diagnostic process, disease management, and pharmacological treatment is warranted, with therapeutic decisions made on a case-by-case basis.

All in all, our findings highlight the central role of MDD in the diagnostic pathway of suspected LP, particularly when characteristic HRCT findings coexist with a relevant exposure history. By integrating clinical and radiological information and selectively incorporating pathological data when available, MDD may support the diagnosis in selected patients, although histopathological confirmation remains the reference standard when feasible. This approach underscores the importance of considering LP in the differential diagnosis of ILD and systematically assessing mineral oil exposure in patients with compatible radiological findings.

Our case series has several limitations. First, the small number of study participants as well as the retrospective design limit the generalizability of our results. Second, histopathological confirmation was available in only one patient; TBB was performed in two patients but was non-diagnostic in one, likely due to sampling limitations. Third, long-term follow-up was not uniformly available, precluding a comprehensive assessment of radiological and functional outcomes after exposure cessation. Finally, the literature search supporting the discussion was non-systematic and based on the authors' judgment; therefore, some relevant studies may not have been included.

Conclusions

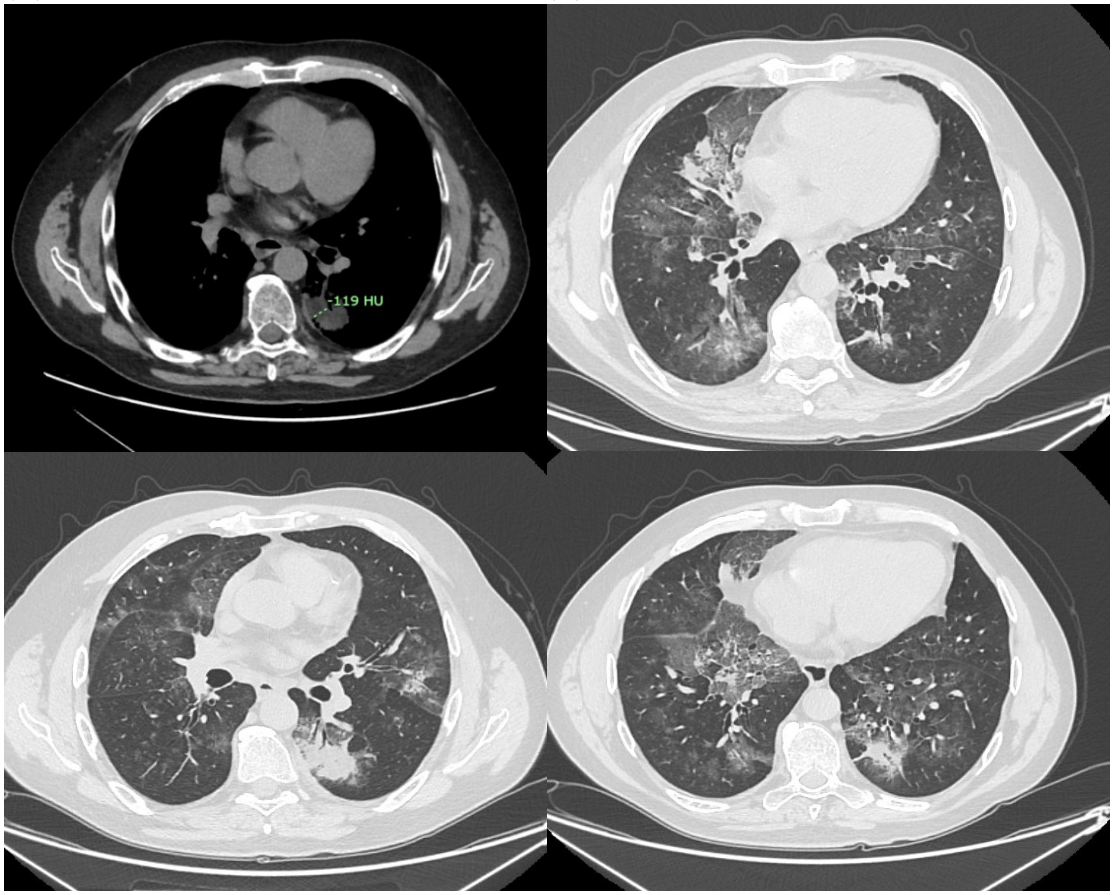
Our case series highlights the relevant role of MDD in the diagnosis of chronic exogenous LP. The integration of exposure history and characteristic HRCT findings may support a confident diagnosis in selected patients, although histopathological confirmation remains the reference standard when it can be obtained. Larger prospective studies are warranted to validate the role of MDD, and HU measurements in the diagnostic workup of LP, including their potential to reduce the need for invasive procedures, and to better define the natural history and optimal management of LP.

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(A) (B)



(C) (D)

Figure 1. A-D) Chest HRCT findings in Case 1. Chest CT demonstrates bilateral multifocal consolidations with extensive ground-glass opacities, interlobular septal thickening, and a crazy-paving pattern, with predominant involvement of the lower lobes, lingula, and right middle lobe. Foci of fat attenuation within the pulmonary consolidations were also observed in the left lower lobe, measuring –119 HU.

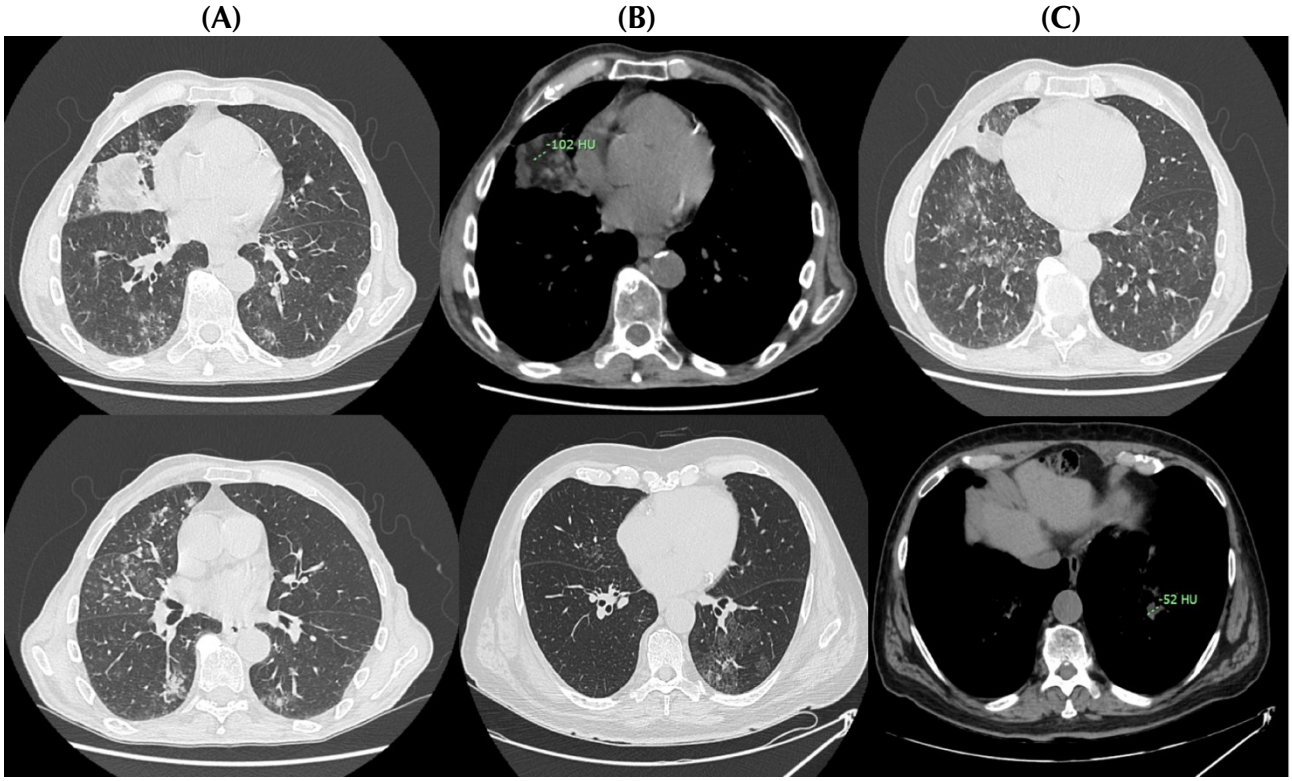


Figure 2. Chest HRCT findings in Cases 2-3. A-D) Case 2: contrast-enhanced chest CT demonstrated a large right middle lobe consolidation containing areas of fat attenuation, with values consistent with adipose tissue (mean attenuation value −102 HU), associated with abrupt interruption of the segmental bronchi. Additional bilateral multifocal parenchymal consolidations were also observed. E,F) Case 3: chest HRCT highlighted multifocal parenchymal abnormalities in the left lower lobe, characterized by ground-glass opacities, consolidations, interlobular septal thickening, and a crazy-paving pattern. Mild bronchiolectasis were observed within the affected areas. A focal area of fat attenuation was identified within the left lower lobe consolidation, measuring a mean attenuation value of −52 HU.

Table 1. Demographics, clinical, radiological, histopathological characteristics and management of LP patients.

Patient	**Case 1**	**Case 2**	**Case 3**
Age/Gender	53 years/ Male	81 years/ Male	82 years /Male
Exposure	Paraffin Oil	Paraffin Oil	Paraffin Oil
Symptoms	Dyspnea	Asymptomatic	Asymptomatic
HRCT findings	Bilateral consolidations, GGOs and crazy-paving and fat attenuation areas (lower lobes, lingula, middle lobe)	Fat-attenuation consolidation, interruption, and bilateral opacities (right middle lobe)	GGOs, crazy-paving, bronchiolectasis with a fat-attenuation area (left lower lobe)
Density HRCT fat attenuation zones (HU)	– 119	– 102	– 52
18F-FDG PET/CT	Mild to moderate hypermetabolic activity	Mild hypermetabolic activity	Not performed
BAL/TBB	BAL cultures: Staphylococcus aureus; TBB: Lipid-like material	BAL microbiology: negative; Nonspecific (non-diagnostic) on TBB;	Not performed
Treatment	Paraffin Oil discontinuation + Corticosteroids	Paraffin Oil discontinuation + Corticosteroids	Paraffin Oil discontinuation

GGOs, ground-glass opacities; HRCT, high-resolution computed tomography; HU, Hounsfield units; MDD, multidisciplinary discussion; PET/CT, positron emission tomography/computed tomography; TBB, transbronchial biopsy; BAL, bronchoalveolar lavage; FDG, fluorodeoxyglucose; LP, lipoid pneumonia.