Hypersensitivity pneumonitis against the background of the use of organic substances, probably mustard powder (clinical case)

We describe a clinical case of hypersensitivity pneumonitis against the background of the use of organic substances, probably mustard powder. 

Patient K is 18 years old and lives in the city. The disease began on 01.11.2022, with complaints of cough with difficult secretion of thick sputum, shortness of breath with slight physical exertion, an increase in body temperature to 37.5 °C, a feeling of palpitations. Complaints were observed for about three weeks and increased in dynamics. Consulted a pulmonologist at a private medical center, where a diagnosis of allergic bronchitis was made and treatment was prescribed, which did not have a positive effect. On 21.11.2022, the family doctor referred him for an X-ray examination, where pathological changes in the lungs were detected. The patient was referred to a pulmonologist for consultation, and a computed tomography (CT) of the chest was also performed. Changes characteristic of hypersensitivity pneumonitis were detected, hospitalized in the pulmonology department of the Ternopil Regional Phthisiopulmonological Medical Center. It is known from the anamnesis that for about three months he worked in the production of food products where mustard powder was used, he did not use respiratory protection means.

Additional examination methods were carried out. Bronchoscopy, conclusion — Catarrhal laryngitis, diffuse bilateral catarrhal tracheobronchitis. Computed tomography of the chest organs dated 22.11.2022, the conclusion is that the picture of the dissemination syndrome in the lungs is more characteristic of acute hypersensitivity pneumonitis. The patient was consulted by a cardiologist. The clinical diagnosis «Hypersensitive pneumonitis against the background of the use of organic substances, probably mustard powder, subacute form, diagnosed for the first time. Pulmonary insufficiency of the 2nd degree. Idiopathic mitral valve prolapse. Metabolic cardiomyopathy. Heart failure of the 0th stage». Treatment is prescribed. 09.12.2022 discharged for outpatient treatment with improvement. According to the data of the control examination (CT dated 09.01.2023) dynamics of partial resorption of hypersensitivity pneumonitis.

Keywords
Hypersensitivity pneumonitis, organic substances, mustard powder.

Hypersensitivity pneumonitis (HP), (exogenous allergic alveolitis, organic pneumoconiosis, farmer’s lung) is a group of allergic pneumopaties that occur due to intensive long-term inhalation of various organic antigens (products of bacteria, fungi, animals) and inorganic dust of professional or domestic nature, is a diffuse granulomatous inflammatory process of the alveoli and interstitial lung tissue, which can be completely reversible and can lead to irreversible damage to the pulmonary architecture. Inhalation of bacterial, fungal, protein antigens of animal and plant origin and drug allergens in high doses and over a certain period of time is of major importance in the development of HP. In addition, genetic factors and peculiarities of the immune response play an important role in the development of the disease.

The American College of Chest Physicians (CHEST) Guidelines note that in patients with suspected HP, it
is recommended to take a thorough medical history of exposure to suspected harmful substances, which can help determine the type, extent, and timing of exposure with the development of clinical symptoms. CHEST notes that the diagnosis of IP should be based on an individualized, patient-centered approach and include a multidisciplinary evaluation, including assessment of the person’s medical history, illness, environment, occupation, and CT scan, and only then should the need for bronchoalveolar lavage and/or lung biopsy be assessed [1, 5].

HP is observed in workers in agriculture (poultry farms, livestock farms, grain farms, etc.), food industry (production of beer, dairy products, yeast, cheese, etc.), textile and clothing industry (processing of fur, cotton, linen), chemical and pharmaceutical industry (production of detergents, plastics, dyes; production of medicines), woodworking industry (wood processing, paper production). In recent years, there has been a significant increase in the incidence of HP associated with inhalation of household allergens [7, 14].

Some authors believe that HP is an immune-mediated inflammatory lung disease, characterized by inhalation of environmental antigens, resulting in acute and chronic lung damage. Along with suggestive clinical and radiologic findings, the history and timing of the alleged antigen exposure are important elements of diagnostic reliability. Unfortunately, many diagnoses remain tentative and are based on vague and inaccurate histories of environmental or material exposure [11].

It was reported that occupational immunologic lung disease is characterized by an immunologic response in the lung to an airborne agent inhaled in the work environment and can be subdivided into immunologically mediated occupational asthma (OA) and hypersensitivity pneumonitis (HP). Irritant-induced OA, a separate nonimmunologic entity, can be due to chronic exposure to inhaled irritants or reactive airways dysfunction syndrome (RADS). RADS is defined as an asthma-like syndrome that persists for > 3 months and occurs within minutes to hours after a single exposure to a high concentration of a respiratory irritant. Workers in high-risk fields for OA include farmers, printers, wood workers, painters, plastics workers, cleaners, spray painters, electrical workers, and health-care workers. OA can be triggered by high-molecular-weight (HMW) proteins that act as complete allergens or by low-molecular-weight (LMW) sensitizers that act as haptons. HMW proteins (> 10 kDa) are generally derived from microorganisms (such as molds and bacteria, including thermophilic actinomycetes), plants (such as latex antigens and flour proteins), or animals (such as animal dander, avian proteins, and insect scales) and are not specifically regulated by the Occupational Safety and Health Administration. LMW haptons that bind to proteins in the respiratory mucosa include some Occupational Safety and Health Administration regulated substances, such as isocyanates, anhydrides, and platinum. HP can present in an acute, chronic, or subacute form. The acute, subacute, and early chronic form is characterized by a CD4+ T-helper type 1 and CD8+ lymphocyte alveolitis. Classically, the bronchoalveolar lavage in HP will show a CD4/CD8 ratio of < 1 [4, 13].

Workers in professions such as millers and bakers are exposed to flour on a daily basis and may be susceptible to occupational diseases. The authors describe a clinical case of HP due to sensitization to flour contaminated with fungi and mites [12].

Farmer’s lung and poultry workers remain the most common forms of occupational disease. Grain and flour are associated with HP. HP was described in workers at a flour mill due to infestation with wheat weevils (Sitophilus species). Isocyanate vapors and aerosols also cause HP. They are used for the mass production of polyurethane polymers, which are widely used in industry. Although isocyanates are not organic dusts, the HP they cause is identical to the HP, associated with organic dusts [6, 9].

Worker exposure to diacetyl, a chemical used in the production of creamy popcorn, was recently found to cause bronchiolitis obliterans, a serious lung disease. This chemical is also used in the production of flavorings to impart a buttery flavor to many foods [8, 10].

The authors compared the spirometry results of workers engaged in the production of popcorn and flavors in the microwave oven. These workers had a higher prevalence of mixed and high severity abnormalities, and some had an excessive decline in lung function. It was found that removal from exposure to harmful factors did not always stabilize the decline in lung function, indicating the need for continuous monitoring. The development of a restrictive model has increased the level of suspicion of a possible work-related disease in workers exposed to flavors [3].

Coffee production is a global industry around the world. Workers in this industry are exposed to complex mixtures of gases, dusts and vapors, including carbon monoxide, carbon dioxide, coffee dust, allergens, alpha-diketones and other volatile organic compounds. Exposed workers may experience adverse respiratory health effects, such as respiratory symptoms, decreased pulmonary function, asthma, and bronchiolitis [15].

Clinical, pathologic, and radiologic features are similar in most cases of HP. Radiology plays a sig-
Significant role in the diagnosis of HP. The characteristic manifestations in acute HP are air-space seals. Findings in subacute HP are patchy areas of attenuation with frosted glass and small centrilobular nodules. Other findings include focal air trapping on exhalation scans and cystic spaces, presumably caused by partial bronchiolar obstruction.

Chronic HP is characterized by the presence of fibrosis superimposed on the signs of acute or subacute HP. The relative preservation of the lung base usually distinguishes it from idiopathic pulmonary fibrosis. Thus, CT scanning is playing an increasingly important role in the evaluation of occupational lung diseases. Characteristic CT findings, together with clinical signs and associated occupational history, improve the diagnostic accuracy of these diseases, including HP [2, 6].

**Objective** — to familiarize practicing physicians and scientists with a clinical case of hypersensitivity pneumonitis due to the use of organic substances, probably mustard powder.

**Clinical case**

*Patient K.* is 18 years old and lives in the city. The disease began 1.11.2022, with complaints of cough with difficult secretion of thick sputum, shortness of breath with slight physical exertion, an increase in body temperature to 37.5 °C, a feeling of palpitations. Complaints were observed for about three weeks and increased in dynamics. Consulted a pulmonologist at a private medical center, where a diagnosis of allergic bronchitis was made and treatment was prescribed, which did not have a positive effect.

21.11.2022, the family doctor referred him for an X-ray examination, where pathological changes in the lungs were detected. The patient was referred to a pulmonologist for consultation, and a computed tomography (CT) of the chest was also performed. Changes characteristic of hypersensitivity pneumonitis were detected, hospitalized in the pulmonology department of the Ternopil Regional Phthisiopulmonological Medical Center. It is known from the anamnesis that for about three months he worked in the production of food products where mustard powder was used, he did not use respiratory protection means. He denies contact with people who came from other countries and patients with coronavirus disease, a rapid test for COVID-19 (22.11.2022) was negative. Complaints at the time of hospitalization: cough with difficulty in discharging thick sputum, shortness of breath with slight physical exertion, fever up to 37.5 °C, palpitations. Objectively: general condition of moderate severity. He is conscious, contactable, adequate. Correct build, the weight is reduced. The skin and visible mucous membranes are pale, cyanosis of the nasolabial triangle. The pharynx is clean, granular. Peripheral lymph nodes are not palpable. The thyroid gland is without induration. Heart rate — 122/min, blood pressure 105/60 mm Hg, respiratory rate 24/min, SpO2 95 % when breathing atmospheric air. The heart is rhythmic, the tones are weakened. Percussion over the lungs is a clear pulmonary sound, shortened in the lower parts. Auscultation of rigid breathing, crepitating rales on exhalation. The abdomen is soft, not painful on palpation. Pasty feet and legs. Physiologic discharges are normal.

Bronchoscopy dated 24.11.2022.

On examination of the larynx, the mucous membrane is hyperemic, with a pronounced vascular network. Mobility of all parts of the larynx is preserved. The vocal folds close during phonation (Fig. 1).

![Bronchocopy: larynx](image1)

Fig. 1. Bronchocopy: larynx

![Bronchoscopy — trachea, tracheal bifurcation](image2)

Fig. 2. Bronchoscopy — trachea, tracheal bifurcation

The tracheal lumen is free; the carina is sharp, mobile; the bifurcation angle is not widened. The tracheal mucosa is hyperemic, with a pronounced vascular pattern (Fig. 2).
Bronchial patency is preserved. The mucosa is hyperemic, with a pronounced vascular pattern. Mobility and elasticity of the bronchi are preserved (Fig. 3, 4).

Conclusion: Catarrhal laryngitis. Diffuse bilateral catarrhal tracheobronchitis.

CT scan of the chest dated 22.11.2022 (Fig. 5). Pulmonary parenchyma of reduced pneumatization, enhanced pulmonary pattern throughout, dissemination of monomorphic centrilobular focal shadows of 2—4 mm of medium intensity, in subpleural areas in some places clustered, separate linear cords. The bronchi are patent, free. No enlarged bronchopulmonary lymph nodes are found. Mediastinal organs are located medially. The mediastinal lymph nodes are enlarged 8—11 mm. Conclusion: The CT picture of pulmonary dissemination syndrome is more characteristic of acute hypersensitivity pneumonitis.

Consultation with a cardiologist (29.11.2022): Idiopathic mitral valve prolapse. Metabolic cardiomyopathy. Heart failure of the 0th stage.

The patient was diagnosed with: Hypersensitivity pneumonitis on the background of the use of organic substances (probably mustard powder), subacute form, first diagnosed. Idiopathic mitral valve prolapse. Metabolic cardiomyopathy. Heart failure of the 0th stage.

Treatment prescribed: *Ambroxol, Thiotriazoline, Dexamethasone, Pulmicort, Medrol.*
Treatment and work recommendations at discharge (09.12.2022): observation by a general practitioner of family medicine, X-ray control of the CT of the in 1 month. Continue on an outpatient basis: Medrol at a dose of 20 mg per day (16 mg at 10:00, 4 mg at 12:00) for 1 month with subsequent CT monitoring, consultation with a pulmonologist and dose adjustment; Omeprazole at a dose of 20 mg per day, continuously while taking Medrol; Calcium-D3 Nicomed at a dose of 1 tablet — 2 times a day continuously while taking Medrol.

CT scan dated January 09.01.2023 (1 month after discharge, Fig. 6). Pulmonary parenchyma of reduced pneumatization, enhanced pulmonary pattern throughout, dissemination of monomorphic centrilobular focal shadows of 2—4 mm of moderate intensity. The bronchi are free, passable. Enlarged bronchopulmonary lymph nodes are not detected. Mediastinal organs are located medially. Enlarged lymph nodes are not detected. Conclusion: dynamics of partial resorption of hypersensitivity pneumonitis.


References

ВИПАДОК З ПРАКТИКИ

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Гіперсенситивний пневмоніт на тлі використання органічних речовин, ймовірно, гірчичного порошку (клінічний випадок)

Описано клінічний випадок гіперсенситивного пневмоніту на тлі використання органічних речовин, ймовірно, гірчичного порошку.

Пациєнт К., 18 років, мешкає у місті. Захворювання почалося 01.11.2022 р. зі скарг на кашель з утрудненим виділенням густого мокротиння, задишку при незначному фізичному навантаженні, підведення температури тіла до 37,5 °C, відчуття серцебиття. Скарги спостерігались близько 3 тиж і наростали в динаміці. Проконсультований у пульмонолога в приватному медичному центрі. Установлено діагноз «алергійний бронхіт». Призначено лікування, яке не дало позитивного ефекту. 21.11.2022 р. сімейним лікарем скерований на рентгенологічне обстеження. Виявлено патологічні зміни у легенях. Пацієнт направлений на консультацію до пульмонолога. Проведено комп’ютерну томографію органів грудної порожнини (КТ ОГП). Виявлено зміни, характерні для гіперсенситивного пневмоніту. Пацієнта госпіталізували у пульмонологічне відділення Тернопільського регіонального фтизіопульмонологічного медичного центру. З анамнезу відомо, що близько 3 міс працював на виробництві харчової продукції, де використовували гірчичний порошок. Застосування бронхиальних захисних засобів не було.

Проведено додаткові обстеження. Бронхоскопія: катаральний ларингіт, дифузний двобічний катаральний трахеобронхіт. КТ ОГП (22.11.2022 р.): картина синдрому дисемінації в легенях, характерна для гострого гіперсенситивного пневмоніту. Хворий проконсультований кардіологом. Установлено клінічний діагноз «Гіперсенситивний пневмоніт на тлі використання органічних речовин (ймовірно, гірчичного порошку), підгостра форма, вперше встановлений. Легенева недостатність ІІ ступеня. Ідіопатичний пролапс мітрального клапана. Метаболічна кардіоміопатія. Серцева недостатність 0 стадії». Призначено лікування. 09.12.2022 р. пацієнта виписано на амбулаторне лікування із поліпшенням. За даними контрольного обстеження (КТ ОГП, 09.01.2023 р.), динаміка часткового розсмоктування гіперсенситивного пневмоніту.

Ключові слова: гіперсенситивний пневмоніт, органічні речовини, гірчичний порошок.

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