BRZYSKA, Anna, KOPIEC, Dominika and KUZIOŁA, Karolina. Extrinsic allergic pneumonitis - classification, pathogenesis, diagnosis. Journal of Education, Health and Sport. 2023;46(1):314-322. eISSN 2391-8306.
https://dx.doi.org/10.12775/JEHS.2023.46.01.022
https://apcz.umk.pl/JEHS/article/view/45403
https://zenodo.org/record/8285222

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 17.07.2023 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences).
Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 17.07.2023 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159.
Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 29.07.2023. Revised:21.08.2023. Accepted: 25.08.2023. Published: 29.08.2023.

Extrinsic allergic pneumonia - classification, pathogenesis, diagnosis

Alergiczne zapalenie pęcherzyków płucnych - klasyfikacja, patogeneza, diagnostyka

Brzyska Anna[2] , Kopiec Dominika[1] , Kuzioła Karolina[1]

[2]Student's Research Groupat the Department of Epidemiology and Clinical Research Methodology, Medical University of Lublin

[1]Student's of the faculty of Environmental Biology, University of Life Sciences in Lublin

ORCID ID

Brzyska Anna https://orcid.org/0000-0002-8724-1645, a.brzyska09@gmail.com
Kopiec Dominika https://orcid.org/0000-0001-9931-4242, dominikakopiec4683@gmail.com
Kuzioła Karolina https://orcid.org/0000-0003-3560-2346, karolinakuziola.21@gmail.com

Abstract:
Introduction and objective: Extrinsic allergic pneumonitis (AZPP) is an inflammatory disease of the lung parenchyma and bronchioles, caused by inhalation of organic and inorganic antigens. The pathhomechanism of the disease is based on the binding of the antigen with precipitins to form immune complexes that are responsible for the formation of acute inflammation in the lung tissue. The resulting inflammation is a type III and type IV hypersensitivity reaction. In the clinical course, azpp is divided into acute, subacute and chronic phases. The course of the disease varies depending on the type and duration of exposure to the antigen. It is most often manifested by shortness of breath, coughing and the progression of the disease leads to respiratory failure.
Review methods: While writing the thesis, a database was used, ie Pubmed and Google Scholar.
Brief description of the stage of knowledge: Extrinsic allergic pneumonitis requires a thorough differential diagnosis, which includes laboratory tests, functional tests, imaging tests, inhalation provocation tests and lung biopsy. The mainstay of treatment is to avoid exposure to the antigen. In severe disease, systemic corticosteroid therapy is indicated.
Summary: Correct diagnosis is a big problem because of the differences in symptoms and the severity of the disease among patients. Expanding the knowledge about the clinical course of the disease or its pathogenesis will affect the effectiveness of diagnostics and help to develop new methods of treatment.

Key words: extrinsic allergic pneumonitis, diagnostics, treatment, prognosis

Introduction and purpose of the work

Allergic alveolitis is defined as a complex disease syndrome with the occurrence of inflammation of the lung parenchyma and bronchioles, caused by chronic inhalation of environmental antigens. Due to the fact that it causes inflammatory changes also in the

terminal bronchioles and the interstitium of the lungs, it is also referred to as hypersensitivity pneumonitis [1]. The antigens causing azpp can be particles of proteins of animal, plant, fungal or bacterial origin, as well as inorganic ones floating in the air. After getting into the body by inhalation or dermal route, they affect the human immune system and thus cause an excessive immune reaction in people sensitive to them [2]. The cause of the lesions are two types of hypersensitivity reactions, i.e. type III and IV [3]. Cough and shortness of breath are the most common complaints among people with asp. Atypical symptoms accompanying the diagnosis of AD include fever, headache, muscle pain and weight loss [2]. The aim of the paper is to review the current knowledge about allergic alveolitis.

EPIDEMIOLOGY

Allergic alveolitis is the third most common interstitial lung disease after idiopathic fibrosis and sarcoidosis. In European countries, the discussed disease entity constitutes 4-15% of all diagnosed lung diseases, while in Poland its incidence is estimated at 1.26/100,000. The occurrence of asp is influenced by several environmental factors, including antigen concentration, duration and frequency of exposure. The size of the inhaled particles and their degree of solubility in water are also important. The discussed disease entity affects many professional environments, but farmers, poultry breeders, workers employed in the chemical or food industry are particularly exposed to contact with allergens in the work environment. Less common but equally important is the detergent lung, from which people exposed to detergents suffer. In agriculture, allergic alveolitis predominates in the form of farmer's lung, which is influenced by antigens of bacterial and fungal origin. In moldy hay, there are m.in. bacteria Saccharopolyspora rectivirgula, Thermoactinomyces vulgaris and fungi Aspergillus spp. Specific antigens in the chemical industry are phthalic acid carbides and isocyanides [4].

ETIOLOGY AND PATHOGENESIS

Allergic alveolitis is caused by an inflammatory reaction due to the inhalation of an antigen causing the body's immune response. The most common response is type III and type IV.

Stimulating antigens can be proteins of plants, animals or other microorganisms, which, after getting into the human body and combining with its proteins, form haptens. Viral infections can trigger or exacerbate pre-existing hypersensitivity to home or work antigens by stimulating the release of inflammatory cytokines. In addition, cigarette smoking has a significant impact on the acceleration of the process of developing pulmonary fibrosis [5]. Asp has an acute, subacute and chronic course. The acute form of the disease is associated with the occurrence of immune complexes characteristic of type III responses. The production of characteristic antibodies precipitating in the IgG class is also observed along with the presence of neutrophilic infiltrates. The delayed-type cellular response predominates in the subacute and chronic course of the disease. It arises as a result of a Th1-mediated cellular response, which is manifested by the presence of granulomatous lesions and cellular infiltrates. Inflammation along with the presence of cellular infiltrates in the lungs are the result of irritation of membrane receptors recognizing TLRs patterns which is manifested by the presence of granulomatous changes and cellular infiltrates [2].

SYMPTOMS AND CLINICAL COURSE

There are three forms of AD, i.e. acute, subacute and chronic. All forms of the disease differ from each other in the time of exposure to a given allergen and in the symptoms. In the acute form, symptoms such as dry cough, chills, fever, shortness of breath and myalgia appear 2 to 9 hours after intense exposure. These symptoms disappear within 24-48 hours from the end of exposure. The acute form is manifested on physical examination by symmetrical crackles in the lower part of the lungs or occasional wheezes heard during the patient's auscultation. The subacute form develops with continuous, repeated exposure lasting several weeks. The characteristic symptoms are a dry cough with shortness of breath and greater fatigue of the worker. Physical examination shows bilateral crepitations located throughout the lungs. The chronic form has a significant impact on the human body, as progressive dyspnoea and reduced lung function lead to hypoxemia. During auscultation of the lungs, constant crackles are observed [3].

DIAGNOSTICS

Laboratory tests, functional tests, imaging tests, inhalation provocation tests and lung biopsy are used to diagnose asthma. The first test that can confirm the presence of the disease is the indication of precipitins from the IgG class in the blood serum. However, their presence alone is not enough to determine the final diagnosis and leads to further tests, including spirometry. Spirometry is a type of lung function test that reveals restrictive or obstructive-restrictive gas exchange disorders [4]. The correct diagnosis of AZPP is based on a detailed history, physical examination, radiological and functional examination, examination of bronchoalveolar lavage fluid, lung biopsy is rarely necessary. BALF (bronchoalveolar lavage fluid test) and the serum of patients with AZPP make it possible to detect antibodies precipitating in the IgG class, directed against the suspected antigen. Results without precipitins do not rule out AD, as this may occur in chronic disease.

A 6-minute walk test is useful in monitoring and progressing the disease. This method is included in the methods of lung function testing. The gait test can be performed on any person who does not have contraindications such as heart failure or musculoskeletal disorders [1]. In the diagnosis of AZPP, a standard X-ray may also be helpful, in the posterior-anterior and lateral projection. However, this disease does not cause characteristic changes that could be revealed by X-ray, so the X-ray alone cannot rule out AD. In the acute form, however, a "milk glass image" can be observed, especially in the lower lobes. In the chronic form, the image may not show any changes, and the image of "milk glass" may appear as in the acute form with accompanying fine-cavity changes in the form of "honeycomb".

Transbronchial biopsy is also one of the methods of diagnosing the disease. Since transbronchial biopsy was introduced, transbronchial biopsy has been performed much more frequently. Biopsy may show histopathologic changes that are distinctive but not pathognomonic for AD. Such lesions include lymphocytic infiltrates, foamy macrophages, granulomas, bronchiolitis, and fibrosis. In a more advanced form, where fibrosis predominates, the changes may be indistinguishable from other causes of pulmonary fibrosis.

Due to the diversity of the clinical picture and the dynamics of the course of ADPP, the diagnosis should be based on certain stages:

1. Obtain confirmation of exposure to the antigen and collect information about the time, frequency of contact with the allergen and the type of allergen,
2. Establish a relationship between symptoms (shortness of breath, cough, crackles at the base of the lungs) and exposure to the antigen,

3. Obtain a typical image in BALL and in a lung biopsy,
4. Check for the presence of percipins, that is, confirm the immune response to the antigen,
5. Find changes in X-ray and HRCT,
6. Diffusion capacity impairment (DLCO) [4].

TREATMENT

In the treatment of the described disease entity, it is particularly important to eliminate the antigen from the patient's work environment. The acute form of the disease usually resolves spontaneously, however, in the absence of positive effects in the form of recovery, administration of systemic corticosteroids is recommended. The treatment regimen should include prednisone at a dose of 0.5 - 1 mg/kg/d for 1 to 2 weeks in case of acute/subacute disease. Then, a maintenance dose of approximately 10 mg/day is recommended. In the case of progressive fibrosis that does not respond to treatment, lung transplantation is recommended [6].

PROGNOSIS

The prognosis for asp depends on the exposure time to the antigen and its concentration. In the chronic form of the disease, relief of symptoms and partial recovery are common. There are exceptions to this rule, as in some people the disease progresses and leads to irreversible pulmonary fibrosis and death. Especially in the case of a bird breeder, where there are high concentrations of antigens in the air, which are detected in the working environment for a long time, even after removing the animals and cleaning the utility room [6]. Studies conducted in Denmark indicate that in the chronic form of asp, the average survival rate is 7 years. The acute form of the disease, which is diagnosed early enough with appropriate

treatment, has a good prognosis. For a more severe course of the disease, which is associated with a poor prognosis,

SUMMARY

Allergic alveolitis (AP) is a complex disease syndrome caused by inhalation exposure to organic and inorganic particles. These particles, which include bird and animal proteins, fungi, thermophilic bacteria, cause an excessive immune response of the body. The prevalence of the disease in the general population is low and difficult to estimate because the symptoms are often ignored or confused with other diseases [2]. There are three forms of AD, i.e. acute, subacute and chronic.

Due to the diversity of the course of the disease and the clinical picture, the diagnosis should be carried out in several stages, starting with obtaining confirmation of the antigen and collecting the history of exposure time, frequency and type of allergen. However, it is especially important to eliminate the antigen from the environment of the sick person. The prognosis of AZPP in a patient depends primarily on exposure to the antigen and its exposure. Among the preventive measures, it is worth mentioning constant health and work environment control, or employee education on the effects of an excessive immune response. If necessary, employees should be equipped with personal protective equipment that reduces the effect of the antigen on the body.

Declarations

Funding

This research has received no external funding.

Author contributions

Conceptualization, K.D. and K.K.; Methodology, A.B.; Software, K.D. and A.B.; Validation, K.K., A.B., and K.D.; Formal Analysis, A.B.; Investigation, K.D., K.K. and A.B Resources, K.K., A.B., and K.D.Data Curation, K.D. and K.K.; Writing – Original Draft Preparation,. K.K., A.B., and K.D, Writing – Review & Editing, K.K, K.D Visualization, A.B. and D.K.; Supervision, A.B., D.K.; Project Administration, K.K., A.B., and K.D.

Conflicts of interest

The authors declare no conflict of interest.

Bibliography

1. Jędrych, M. E., Szturmowicz, M., Bestry, I., & Kuś, J., Alergiczne zapalenie pęcherzyków płucnych–kryteria rozpoznania, leczenie, rokowanie i zapobieganie. Medycyna Pracy, 2016. 67(4), 517-527. DOI https://doi.org/10.13075/mp.5893.00406
2. Jędrych, M. E., & Kuś, J. Alergiczne zapalenie pęcherzyków płucnych–epidemiologia, etiologia, immunopatogeneza, obraz kliniczny. Postępy Nauk Medycznych 1/2016, s. 44-48
3. Lewandowska, K. „Alergiczne zapalenie pęcherzyków płucnych. Extrinsic allergic alveolitis (hypersensitivity pneumonitis)" Borgis Postępy Nauk Medycznych, 2011.s 274285.
4. Fal, A. M. Alergiczne zapalenie pęcherzyków płucnych allergic alveolitis. Wiadomości Lekarskie, 2020, 73(8), 1593-1599, DOI: 10.36740/WLek202008101
5. i Mark Hamblin , Helmut Prosch , Martina Vašáková, Diagnostyka, przebieg i leczenie zapalenia płuc z nadwrażliwości, Europejski przegląd oddechowy ,2022, 31: 210169; DOI:10.1183/16000617.0169-2021
6. Spagnolo, P., Rossi, G., Cavazza, A., Bonifazi, M., Paladini, I., Bonella, F., & Costabel, U.,. Hypersensitivity pneumonitis: a comprehensive review. Journal of investigational allergology & clinical immunology, 2015, 25(4), 237-50.
7. R. Nogueira, N. Melo, H. Novais e Bastos, N. Martins, L. Delgado, A. Morais, P. C. Mota,, Hypersensitivity pneumonitis: Antigen diversity and disease implications,

Pulmonology, 2019 ,25(2), s 97-108, DOI: https://doi.org/10.1016/j.pulmoe.2018.07.003.