

Case 242

4. Chronic eosinophilic rhinosinusitis

【Progress】

He is scheduled to be given steroid therapy.

【Discussion】

As the diseases with increase of eosinophils, they are listed: acute eosinophilic pneumonia, chronic eosinophilic pneumonia, eosinophilic sinusitis, eosinophilic otitis media (tympanitis), eosinophilic esophagitis, eosinophilic gastritis. Further, eosinophil counts increase in case of parasite infection, allergy to a certain drug or food, asthma, hay fever, eczema, Crohn's disease, eosinophilic granulomatosis with polyangiitis, leukemia and Hodgkin's lymphoma. The count of eosinophil in normal state is less 5% of white blood cells: $8000 \times 0.05 = 400/\text{mm}^3$. The definition of eosinophilia is 500 or greater in blood (1).

Sinusitis is categorized into bacterial sinusitis, allergic fungus sinusitis, eosinophilic mucin rhinosinusitis and odontogenic maxillary sinusitis. Bacterial sinusitis occurs following viral sinusitis which makes fluid collection in paranasal sinus. When inflammatory fluids by viral sinusitis increase and accumulate in paranasal sinus, inducing the blockade of the ostium and meatus between paranasal sinus to nasal lumen, secondary bacterial sinusitis occur. The potent bacterial sinusitis leads to empyema (2-4).

When chronic bacterial sinusitis with the usage of antibiotics continue, fungus sinusitis can arise, inducing allergic fungus sinusitis. In cases of both allergic fungus sinusitis and eosinophilic rhinosinusitis, the count of eosinophils in blood test elevate. It indicates difficulty of diagnosing to identify the exact diagnosis.

CT is useful to diagnose sinusitis from neoplasm because neoplasm often induce bone erosion or destruction while sinusitis does not. Further, it is also useful to identify maxillary sinusitis from odontogenic origin because CT visualize clearly maxillary sinus and odontoid structure such as tooth and gingiva. Furthermore, CT is excellent to identify calcified lesion in the sinusitis which is characteristic of fungus infection. However, in case of no calcified lesion, it is difficult between allergic fungus sinusitis and eosinophilic mucin rhinosinusitis because both lesions are visualized as thick mural thickening with slight high attenuation which is corresponded to mucin production on CT (5). In this situation, MRI is useful to differentiate allergic fungus sinusitis from eosinophilic mucin rhinosinusitis because MRI with T2WI shows the lesion with low signal intensity of allergic mucin since mucin owns high viscosity irrespective of calcification or not (5). Meanwhile T2WIMRI shows the lesion with high signal intensity on eosinophilic mucin rhinosinusitis since mucosal edema effect surpass mucin effect. Eosinophilic mucin rhinosinusitis occurs more often as symmetric lesion with edema on ethmoid sinus, while allergic fungus sinusitis occurs as asymmetrical and/or plural sinus lesions (5).

Eosinophil contains around 200 granules and secretes single, pleural, many or all granules dependent on cytokine information by other immune cells. Eosinophils life or presence span are about 10 hours in vessels while about 10 days in tissue. IL 5 from helper T cell and eotaxin from epithelial cells make eosinophils life span longer (6).

Eosinophilic granules contain histaminase, RNase, DNase, peroxidase, plasminogen, lipase and major basic proteins, while granules of basophils and mast cells contain histamine, heparin and major basic proteins. Major basic proteins are found in the severe damage of bronchial cells in autopsied bronchus of patients passed away due to asthma, indicative of causative protein (7, 8). Eosinophils attack pathogen of virus and parasites using these granules along with basophils and mast cells. Mast cells and helper T cell secrete IL 5 to recruit eosinophils. Thinking of the roles of granules eosinophils and basophils & mast cells, basophils and mast cells contain the similar positive role granules while eosinophils contain not only the positive role granules as well as the negative role granules (7, 8). Namely, the aim to recruit eosinophils by mast cells is not only to cooperate together but also to negate the effect of basophils & mast cells. Allergy by mast cells & basophils and eosinophils is thought to occur for localization of the pathogen or antigen, in other words, allergy occurs when it is difficult for macrophages and neutrocytes to cope with antigen and pathogen. Eosinophils cooperate pathogen with basophils & mast cells using RNase, DNase and major basic proteins but negate the effects of basophils & mast cells using histaminase, peroxidase and plasminogen.

【Summary】

We presented a sixty three year-old male with olfactory sensation. As past illness history, he experienced bronchial asthma, middle lobe syndrome and dermatofibrosarcoma protuberans. Laboratory test revealed white blood cells 4750/mm³, eosinophils 12.4% (589/mm³). Face CT showed symmetric sinusitis on ethmoid sinus with a little high density, indicative of mucin production. It is borne in mind that mucin itself is visualized low signal intensity on T2WIMRI because of its viscosity. In fact, the lesion of allergic fungus sinusitis is visualized low signal intensity on T2WIMRI but the lesion of eosinophilic mucin rhinosinusitis, high signal intensity on T2WIMRI because edematous change surpasses mucin viscosity, indicative of usefulness of MRI for differentiation between them. Eosinophils contain about 200 granules whose roles are cooperative with basophils and mast cells using RNase, DNase and major basic proteins but are negative against the effects of basophils and mast cells using histaminase, peroxidase and plasminogen.

【References】

- 1.Radojicic, C et al. Sinusitis. Rhinology. 2019;57:67-72.
- 2.Bent JP 3rd, Kuhn FA. Diagnosis of allergic fungal sinusitis. Otolaryngol Head Neck Surg 1994;111:580-8. [Crossref] [PubMed]
- 3.Ferguson BJ. Categorization of eosinophilic chronic rhinosinusitis. Curr Opin Otolaryngol Head Neck Surg 2004;12:237-42. [Crossref] [PubMed]
- 4.Pant H, Kette FE, Smith WB, et al. Eosinophilic mucus chronic rhinosinusitis: clinical subgroups or a homogeneous pathogenic entity? Laryngoscope 2006;116:1241-7
- 5.Meng Y, et al. The use of magnetic resonance imaging in differential diagnosis of allergic fungal sinusitis and eosinophilic mucin rhinosinusitis. J Thorac Dis 2019;11:3569-3577.
- 6.Wechsler ME, et al. Mepolizumab or Placebo for Eosinophilic Granulomatosis with Polyangiitis. The New England Journal of Medicine. May 8, 2017; 376(20):1921-1932
- 7.Stone KD, et al. IgE, mast cells, basophils, and eosinophils. J Allergy Clin Immunol. 2010 ;125:73-80.
- 8.Diny NL, et al. Eosinophils in Autoimmune Diseases. Front. Immunol. 2017 <https://doi.org/10.3389/fimmu.2017.00484>

