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Kartagener Syndrome: A Case Report

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A B S T R A C T

Kartagener syndrome (KS) is a rare autosomal recessive disorder characterized by a clinical triad of situs inversus, chronic sinusitis, and bronchiectasis. Impaired ciliary motility due to abnormal ciliary structure or function is the main pathophysiological problem in KS. A 38-year-old woman presented to our outpatient clinic with a productive cough, fever, and shortness of breath for 1 month. She has had recurrent episodes of respiratory tract infections since childhood. Clinical investigations revealed situs inversus, sinusitis, and bronchiectasis. She was diagnosed with KS and treated with antibiotics, mucolytics, bronchodilators, and chest physiotherapy. Patients with KS present with chronic recurrent respiratory tract infections due to ineffective mucociliary clearance. Early diagnosis is important to improve prognosis. The main goals in the management of KS are to prevent the progression of the disease, preserve pulmonary function, and improve quality of life.

1. Introduction

Kartagener syndrome (KS) is a rare autosomal recessive genetic ciliary disorder that consists of a triad of situs inversus, chronic sinusitis, and bronchiectasis. The incidence of KS is about 1 in 30.000-40.000 live births.[1] Siewert first reported the combination of situs invertus, chronic sinusitis, and bronchiectasis in 1904.[2] Manes Kartagener described this syndrome in detail in 1933 as a distinct congenital syndrome bearing his name.[3] The main pathophysiological problems of KS result from abnormal ciliary structure or function. During the embryonic stage, the position of internal organs is determined by uniform ciliary beating, but in KS, the organs fail to move to the left side due to ciliary dysmotility, resulting in situs inversus. Patients with KS usually present with recurrent respiratory tract infections due to ineffective mucociliary clearance.[4] Here, we report a case of a 38-year-old woman with KS who had a recurrent respiratory tract infection since childhood.

2. Case Presentation

A 38-year-old unmarried woman from Ketapang Regency, West Kalimantan, Indonesia, presented to our outpatient clinic in Dr. Agoesdjam General Hospital in Ketapang Regency with a complaint of productive cough of yellowish sputum, fever, and shortness of breath for 1 month. She also complained of intermittent rhinorrhea, nasal obstruction, and headache. These symptoms have been getting worse since 1 week prior to presentation. Since childhood, she had repeated episodes of similar symptoms for which she used to take drugs from her primary physicians. She had been treated for having chronic sinusitis and recurrent pneumonia and received several courses of oral antibiotics, antihistamines, bronchodilators, mucolytics, and corticosteroids, but the response was only incomplete and transient. She had even been treated for pulmonary tuberculosis (TB) 20 years back as acid-fast bacilli negative TB, but there was no significant improvement in symptoms after completing 6 months of anti-TB treatment. She had no history of cigarette smoking. There was no history of a similar disease in her family.

On physical examination, she was alert and oriented, her blood pressure was 130/80 mmHg, her heart rate was 90 beats/min regular, her respiratory rate was 26 breaths/min, her body temperature was 38^{o}C, and oxygen saturation was 94% on room air. A lung examination revealed diffuse Ronchi in both lung fields. On cardiac examination, an apex beat was felt in the fifth intercostal space along the right midclavicular line, and heart sounds were best heard at the right sternal border. She had grade 2 clubbing of all fingers (Figure 1). Other physical examinations were unremarkable.

Figure 1. Photograph of both hands showing clubbing fingers.

Laboratory examination revealed leukocytosis with a WBC level of 13.7 x 10^3/µL, a hemoglobin level of 14.0 g/dL, and a platelet count of 430 x 10^3/µL. The serum erythrocyte sedimentation rate (ESR) was elevated at 64 mm/hr. Sputum examination for acid-fast bacilli (AFB) staining was negative for *Mycobacterium tuberculosis*. Chest X-ray revealed dextrocardia with right-sided aortic arch and bronchiectasis on both lung fields (Figure 2A). X-ray of paranasal sinuses revealed haziness of all sinuses, indicating pansinusitis (Figure 2B). An electrocardiogram (ECG) revealed sinus rhythm with right axis deviation, global negativity in the lead I and aVL, global positivity in lead aVR, and absent R wave progression in lead V1-V6, consistent with typical characteristics of dextrocardia (Figure 3). Abdominal ultrasonography (USG) revealed liver and gallbladder on the left side and spleen on the right side, indicating situs inversus (Figure 4). A chest computed tomography (CT) scan revealed dextrocardia with infected bronchiectasis on both lungs (Figure 5).

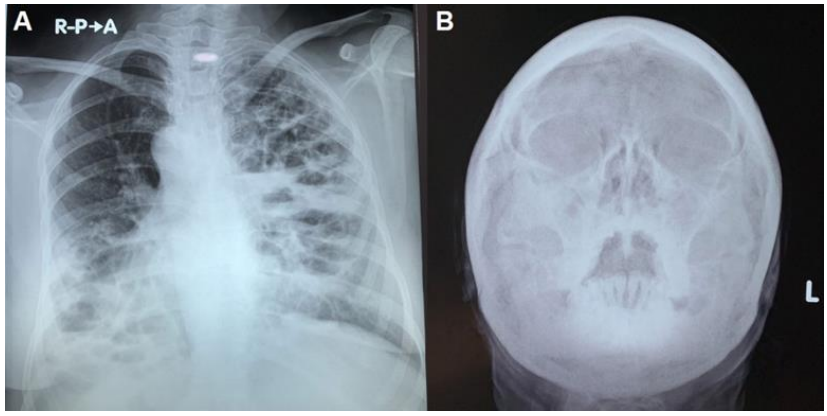

Figure 2. Chest X-ray showing dextrocardia with bronchiectasis (A). X-ray of paranasal sinuses (Water's view) showing diffuse haziness of all sinuses (B).

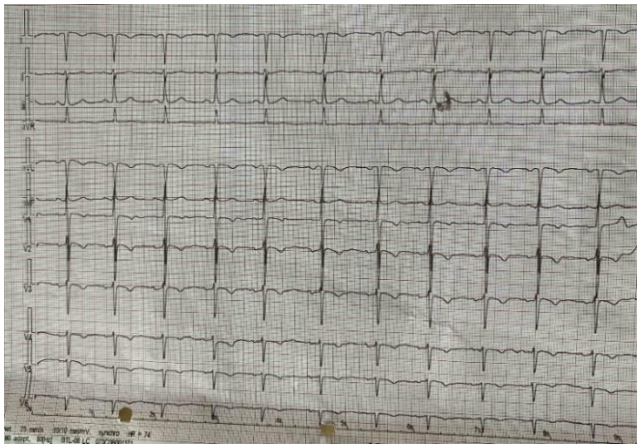

Figure 3. ECG showing sinus rhythm with right axis deviation, completely negative lead I and positive lead aVR, and progressively decreasing R-wave amplitude from V1-V6, indicating dextrocardia.

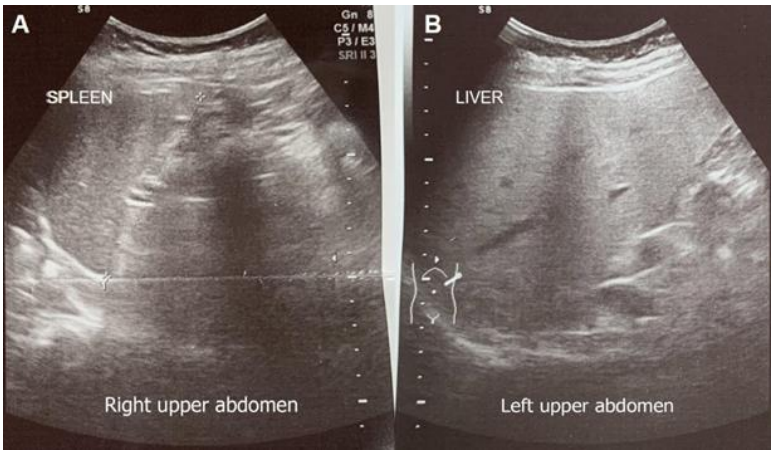

Figure 4. Abdominal USG showing spleen on the right upper abdomen (A) and liver on the left upper abdomen (B).

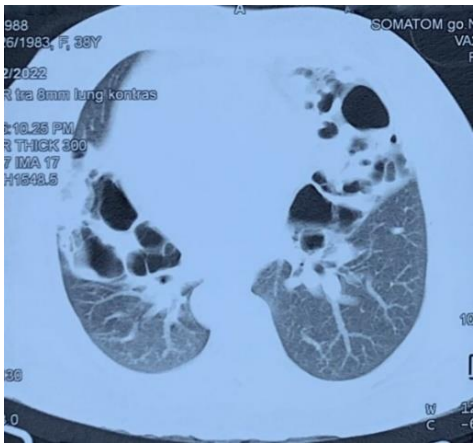

Figure 5. Axial post-contrast chest CT scan showing bilateral multiple cystic bronchiectases

The diagnosis of KS in this patient was made based on the clinical triad of situs inversus, bronchiectasis, and sinusitis. She was treated with oral antibiotics, mucolytics, bronchodilators, and chest physiotherapy. After 1 week, she was symptomatically better, although she continues to have an intermittent cough with mild intensity. She had a routine follow-up in our outpatient clinic every month.

3. Discussion

Clearance of mucus and debris in the airways is obtained through 3 mechanisms: coughing, mucociliary activity, and alveolar clearance. Disorder of ciliary structure or function leads to impaired clearance and causes chronic sinopulmonary diseases such as chronic sinusitis and bronchiectasis.[5] Primary ciliary dyskinesia (PCD), also known as immotile cilia syndrome, is a genetically determined disorder caused by inherited dysfunction of the ciliary apparatus. In the majority of cases, it is transmitted as an autosomal recessive trait. The clinical manifestations of PCD cover a wide spectrum, mainly affecting the cilia in the upper and lower airways and the reproductive system. All forms of PCD are marked by dysmotility or even complete immotility of the cilia in the epithelial cells of the airway, spermatozoa, and other ciliated cells.[6]

KS is a subtype of PCD characterized by the triad of situs inversus, chronic sinusitis, and bronchiectasis. KS is the most common and serious form of PCD, which accounts for 50% of all cases of PCD. Cilia are widely found in various tissues and organs, such as the respiratory tract, paranasal sinuses, ear, eustachian tube, and sperm flagella. Patients with KS generally present with recurrent upper and lower respiratory tract infections due to ineffective mucociliary clearance. The symptoms may include recurrent rhinitis, sinusitis, otitis media, and chronic lower respiratory tract infections leading to bronchiectasis.[7,8,9] In men, ciliary dysfunction may lead to the immobility of spermatozoa, causing infertility. In women, ciliary dysfunction in the oviduct or endometrium may lead to an increased risk of ectopic pregnancy and infertility.[10]

In PCD, gene mutations are not only found in a single gene or locus but are found in many genes. Until now, there are more than 40 gene mutations have been identified in PCD patients. The main gene mutations that lead to this disease are mutations in the dynein axonemal heavy chain 5 (DNA H5) and dynein axonemal intermediate chain 1 (DNA I1).[11] Mutations in these genes result in immotile or markedly hypokinetic cilia due to missing dynein arms.[12] During embryogenesis, cilia play an important role in the correct lateralization of the organs. Normal ciliary beating plays an important role in pushing the heart to the left side. Dysfunction of cilia leads to random

lateralization and situs inversus in a half of cases of PCD.[13]

Our patient presented with repeated episodes of sinusitis and pulmonary infections. Imaging examinations revealed situs inversus, sinusitis, and bronchiectasis, which fulfilled the triad of KS. KS is often misdiagnosed as chronic bronchitis and pulmonary TB but has poor therapeutic effectiveness. KS should be kept in the differential diagnosis in patients presenting with chronic recurrent respiratory infections. Early diagnosis of KS is crucial to prevent progressive worsening of lung function.[14] The recommended diagnostic criteria of KS are the history of chronic rhinosinusitis, bronchitis, or chest infections since childhood along with one or more of the following features: (a) situs inversus in a patient or sibling, (b) living but immotile spermatozoa, (c) reduced or absent tracheobronchial clearance, and (d) characteristic ultrastructural defects of cilia on electron microscopy.[15]

There are two types of tests that can be done in diagnosing KS, including screening tests and diagnostic tests. Screening tests include exhaled nasal nitric oxide test, which is typically low in PCD/KS, and a saccharin test to assess the mucociliary function of nasal epithelium. Diagnostic tests include analysis of ciliary beat pattern and beat frequency using video recording and transmission electron microscopy of the mucosal cilia to confirm ultrastructural ciliary defects.[16] In our case, we could not perform these screening or diagnostic tests due to limited resources, and the diagnosis was based on a combination of clinical and radiographic data.

As a genetic disease, KS has no definitive treatment. The main treatment goals are to prevent the progression of the disease, preserve pulmonary function, and improve quality of life. Standard treatment for sinopulmonary infections in KS includes mucolytics, bronchodilators, antibiotics, and chest physiotherapy.[17] In patients with frequent exacerbations of bronchiectasis (≥3 times/year), a long-term low-dose prophylactic antibiotic is required. Pneumococcal and influenza vaccination should be given to prevent frequent infections.[18] Functional endoscopic sinus surgery (FESS) can be considered to relieve chronic rhinosinusitis.[19] If refractory infection and serious bronchiectasis have occurred, surgical resection of the lung lesion should be considered.[20] In patients with end-stage KS, lung transplantation may be a therapeutic option for controlling symptoms and obtaining long-term survival.[21] Routine clinic visits at least two times per year are recommended to monitor lung function.[22]

4. Conclusion

KS is a subtype of PCD, an autosomal recessive inherited disorder characterized by a clinical triad of situs inversus, chronic sinusitis, and bronchiectasis. The main pathophysiology of KS is ultrastructural defects of cilia leading to immotile cilia. Patients with KS often present with chronic recurrent respiratory tract infections due to ineffective mucociliary clearance. Early diagnosis is important to prevent further complications and improve the prognosis. The main goals in the management of KS are to prevent the progression of the disease, preserve pulmonary function, and improve quality of life.

5. References

1. Arunabha DC, Sumit RT, Sourin B, Sabyasachi C, Subhasis M. Kartagener's syndrome: a classical case. Ethiop J Health Sci. 2014; 24(4): 363-8.
2. Siewert AK. Ueber einen fall van bronchiectasie bei einem patienten mito situs inversus viscerum. Berlin Klin Wochenschr. 1904; 6: 139-41.
3. Kartagener M. Zur pathogenese der bronkiectasien. Bronkiectasien bei situs inversus viscerum. Beitr Klin Tuberk. 1993; 83: 489-501.

4. Pandit S, Choudhury S, Das A, Basuthakur S, Das SK. A rare case of Kartagener's syndrome. J Nat Sci Biol Med. 2014; 5(1): 175-7.
5. Cowan MJ, Gladwin MT, Shelhamer JH. Disorders of ciliary motility. Am J Med Sci. 2001; 321(1): 3-10.
6. Geremek M, Zietkiewicz E, Diehl SR, Alizadeh BZ, Wijmenga C, et al. Linkage analysis localises a Kartagener syndrome gene to a 3.5 cM region on chromosome 15q24-25. J Med Genet. 2006; 43(1): 1-6.
7. Belaldavar BP, Ankale NR, Tubachi J, Khadabadi SN. Kartagener's syndrome - versatile presentations. Int J Pharm Med Bio Sc. 2013; 2(1): 32-7.
8. Kapur V, Chauhan S, D'Cruz S, Sachdev A. Kartagener's syndrome. Lancet. 2009; 373(9679): 1973.
9. Dauksh IA, Aliev AL, Shaislamova GS, Pirnazarova GZ, Maxkamova YS. Syndrome kartagener in children (clinical case of observation). Eur J Mol Clin Med. 2020; 7(2): 3102-11.
10. Sha YW, Ding L, Li P. Management of primary ciliary dyskinesia/Kartagener's syndrome in infertile male patients and current progress in defining the underlying genetic mechanism. Asian J Androl. 2014; 16(1): 101-6.
11. Ibrahim R, Daood H. Kartagener syndrome: A case report. Can J Respir Ther. 2021; 57: 44-8.
12. Horani A, Ferkol TW, Dutcher SK, Brody SL. Genetics and biology of primary ciliary dyskinesia. Paediatr Respir Rev. 2016; 18: 18-24.
13. Boon M, Jorissen M, Proesmans M, De Boeck K. Primary ciliary dyskinesia, an orphan disease. Eur J Pediatr. 2013; 172(2): 151-62.
14. Najafi S, Mohammadpour A, Eshghizadeh M. Kartagener syndrome: a case report. Asian J Pharm Clin Res. 2018; 11(5): 7-9.
15. Harsha PM, Raj GS. Kartagener's syndrome - case series. J Evol Med Dent Sci. 2018; 7(19): 2429-32.
16. Mishra M, Kumar N, Jaiswal A, Verma AK, Kant S. Kartagener's syndrome: a case series. Lung India. 2012; 29(4): 366-9.
17. Tausan D, Ristic A, Zvezdin B. Kartagener's syndrome: a case report. Vojnosanit Pregl. 2016; 73(9): 873-6.
18. Tadesse A, Alemu H, Silamsaw M, Gebrewold Y. Kartagener's syndrome: a case report. J Med Case Rep. 2018; 12(1): 10-3.
19. Tang X, Zou J, Liu S. Endoscopic sinus surgery for treatment of kartagener syndrome: A case report. Balkan Med J. 2013; 30(2): 244-7.
20. Yang D, Liu BC, Luo J, Huang TX, Liu CT. Kartagener syndrome. Qjm. 2019; 112(4): 297-8.
21. Wang B, Zhang X, Jiang W, Huang J, Chen J, et al. Double lung transplantation for end-stage Kartagener syndrome: A case report and literature review. J Thorac Dis. 2020; 12(4): 1588-94.
22. Knowles M, Zariwala M, Leigh M. Primary ciliary dyskinesia. Clin Chest Med. 2016; 37(3): 449-61.