Primary Ciliary Diskinesia

Ximena Fonseca

The importance of normal cilia is based mainly in a correct mucociliary transport.
This is due to the need of a clearance mechanism that can eliminate in the mucous a variety of virus, bacteria, allergens and contaminant particles.
Ciliary abnormalities can be functional, ultrastructural, or both. Generally ultrastructural abnornmalities produce functional disorders.
Functional disorders are related to absence or abnormality of the ciliary beat and mucociliary transport and coordination. Ultrastructural abnormalities are related to the different types of anomalies in the ciliary structure, absence or excess number of elements in the cilia.
Normal population has 5-9 % of abnormal cilia, and in respiratory diseases this can be up to 17% of abnormal cilia.in the mucosa.
There are multiple factors that can affect the ciliary movement. As an example of this, we can mention that *Pseudomona aeruginosa* and *Haemophilus influenzae*, can liberate a substance that can decrease and disorganize ciliary beat. This will produce ciliostasis and its clinical consequences.
Purulent secretions can contain elastase, which can inhibit ciliary motility and damage the respiratory tract.
All of this disorders are secondary ciliary diskinesias.
Normal cilia have a pair of central microtubules and 9 pairs of peripheral microtubules with several connections between them, the most important are the outer and inner dinein arms, and the radial spikes.
The most frequent abnormality in secondary ciliary diskinesia is located at the peripheral microtubules, and the characteristic abnormality in primary ciliary diskinesia (PCD) is the absence or abnormality of the dinein external and internal arms. Some abnormalities in the central part of the cilia can also be found. It is said that external dinein arms regulate the ciliary beat frequency and the internal arms regulate the shape of the wave beat.
To analyze the ciliary ultrastructure we have to count the number of cilia that present a certain defect, it is considered a significant number to find and abnormality in 20% in the studied cilia.

What is primary ciliary diskinesia (PCD)?

Is an hereditary autosomic recesive defect of the ciliary ultrastructure that

produces an abnormal ciliary motility, which produces a chronic oto sino pulmonary disease. The frequency of presentation of this disorder is 1/ 10,000 to 1/20,000 alive newborns. Genetic studies are being conducted to locate the genes responsible for this disease.
Unfortunately there is not a consense in the diagnostic criteria of this cases. Stablishing the diagnosis can be difficult in certain cases, but it is mainly based in the clinical evaluation and ultrastructural ciliar analysis with electronic microscopy. The most significant abnormalities as we mentioned are: shortening or absence of internal and external dinein arms.
To evaluate the function of the cilia the saccharin test can be used, this test can be discussed, because it depends on several external factors, in children it is even more difficult to standarize it. The test consist in depositing a saccharin particle in the anterior part of the nose and measure the time that the patients take to feel the saccharin taste in the mouth. This should take around 30 minutes, a test over 1 hour is considered significatly abnormal.
The use of Tc 99 to evaluate the mucociliary transport can also be an alternative.
Actually the use of exhaled Nitric Oxide as a measurement suggesting primary ciliary diskinesia is a promising feature.
Very low levels of Nitric Oxide have been found in this patients, although this is not an exclusive finding in this disorder, the presence of high levels of Nitric Oxide discards this diagnosis.

Clinical presentation

In the neonate it is charaterized by a permanent rhinitis or nasal congestion. Frequently there is a story of respiratory distress at birth without a reasonable cause to explain it, persistent and humid cough can be found. In 50% of the cases *situs inversus*, primary cilary diskinesia can be found. Gastroesophageal reflux can be found in some cases.
In children and adult population, rhinosinisitis, acute otitis media and otitis media with effusion are frequently found. In some cases children operated with tubes for otitis media with effusion, they persist with otorrhea after their insertion, this is an issue that should alert the possibility of PCD.
It is also frequent to find this cases associated to atypical asthma, chronic cough, bronchiectasis and pneumonias.
The most typical presentation of this disease is Kartagener Syndrome, which includes situs inversus, bronchiectasis, rhinosinusitis and primary cilliary diskinesia.
Our experience in Catholic University Hospital in Chile is the following:
We could confirm with electronic microscope the diagnosis in 33 patients between 1993 and 2003 in our center. Among them we found that recurrent rhinosinusitis was present in 77% of cases, the same with otitis media, and 57% of them had in their clinical record more than 3 episodes of pneumonia. The ultrastructure of the 33 cases revealed abcsense of internal dinein arms in 100% of the cases. In 30 of the 33 patients the dinein arms were abscent in over 50% of the cilia, which represents a great degree of certainty in the diagnosis. The external dinein arms were abscent in 66% of cases.

In summary we can say that when we have a recurrent respiratory infection, we should make an analyze of the possible causes for the recurrence such as allergy, adenoid hypertrophy, inmunological deficits, reflux, etc. The important issue is to have in mind that the primary ciliary diskinesia as one of the possible causes.
To make the diagnosis of primary cilliary diskinesia the patient must have the clinical features described before and there must be a confirmation with electronic microscope of the anomalies in the ultrastructure of the dinein arms.

Recommended readings

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