Paediatric Chronic Rhinosinusitis

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Paediatric rhinosinusitis - otherwise known as the catarrhal child

Nearly all sinus infections follow a rhinitis, there are two or three exceptions: penetrating injuries, diving into deep water, dental infections… but for most people, rhinosinusitis starts in the nose and then involves the sinus, and we all know the definition of rhinitis: it's a symptom complex of running, blocking, itching and sneezing. There are, many causes of rhinitis, but two of the major ones are allergy and infection, especially in children. And in recent years, we have begun to appreciate that these two interact, and that quite often you will find allergy predisposing to infection, and sometimes infections, such as HIV, can predispose the development of allergy.

Rhinosinusitis is defined as either acute, chronic, recurrent acute, or acute on chronic. And I will make some comments about chronic rhinosinusitis (CRS) which, by definition, persists for more than 12 weeks.

The symptoms are not very obvious. It is a little bit like having a bad hangover: you can't concentrate very well, you feel tired, you have postnasal secretions, your nose is blocked up, you probably have facial pain or headache, you don't smell or taste very well, you may well cough, and you may have disgusting smelly breath, which reduces your friends quality of life.

Now, this condition is not rare. If you did a CT scan in your group, one-third of you would have sinus changes. In children, that figure would be 45%, probably because children have far more viral colds. The average child will have 6 to 8 viral colds a year, and in one end of that Gaussian distribution, some children end up having 12 viral colds a year.

Franz Gordts and colleagues looked at MRI scans of 100 children, who were having them for neurological disease, not because there was anything wrong with their nose or sinuses: 45% of them had sinusitis, it tended to be more severe than the pattern one sees in adults, the posterior sinuses were more often involved. All children with discolored nasal discharge had sinusitis [1].

We don't totally know the natural history of this disease. That makes it very difficult to evaluate the treatment. We do know that, for many children, there is spontaneous improvement with age. That's why the doctor that says: "don't worry Mom, it will get better", is probably right. And there are at least three papers suggesting this.

Now why is CRS such a common problem? Well, it probably relates to the fact that we made the mistake of standing up right and then holding our head and our face up. I was reliably informed by my anatomy tutor that horses do not get sinusitis because their faces can drain properly. If you see the way we are arranged, we have sinuses that extend right down to the level of our teeth, but which drain higher up, at around the bridge of our nose, through a very narrow, slit-like orifice. It is a very bad piece of design. And that drainage depends on the fact that cilia can beat and move mucus up from the bottom to the exit, pass it outwards and it is then beat backwards, to the back of the throat, where it is swallowed. We swallow liters of fluid by that route, everyday, most of the time without thinking of it. So, postnasal mucus is a totally normal phenomenon. It becomes abnormal when the quantity or the quality of mucus changes.

What sort of **factors can impact on that difficult clearance mechanism**? There appear to be several. **Anatomical variations** are often cited in the literature. But there are at least three papers that suggest that adults with chronic rhinosinusitis are no more likely to have an anatomical variation, such as a septal deviation, than adults without rhinosinusitis. So, anatomy is probably not a major problem. This is largely a problem of the mucosa. And the sort of things that affect the mucosa are **rhinitis**, **inflammation** – which can be allergic or non-allergic – and then various kinds of **immune deficiency**.

So in an individual patient, you may well find that the sinusitis – here you can see the thick lining of the sinus blocking the osteomeatal complex, and here filling an ethmoid cavity, in some individuals, this will be 'allergic' and I put the allergy between inverted commas because in some patients it is eosinophilic, but skin tests are negative, that's more common in adults; in **children** it will be more often obvious **IgE-mediated allergy**. In others it will be predominantly an infective phenomenon, and in some it will be a mixture of the two.

Lets look at **infection** first of all. Some of you read in this Manual Chapter 4 (from Malak Kotb) about infection and response to infection – how our polymorphisms means that we all respond differently to infecting organisms, some of us successfully clearing them and others having a pathological response. And the idea is that in chronic rhinosinusitis, infection occurs, immune response occurs, and you don't quite completely cure the infection. You may leave just a little bit and that little amount of remaining infection keeps stimulating the local immune response: cytokines, mediators, inflammatory cells. And they, in turn, damage local mucus-ciliary clearance and mucosa, leading to further infection. Thus there is a circle of infection, partial clearance and re-infection until something happens which can make that clearance complete.

In some children, what happens is, maybe, maturation of that immune system. If you look at a child who has sinusitis, you will often find that they do not just suffer from sinusitis. They have middle ear infections, they have tonsillitis, the odds ratios for these are roughly three-fold, you are three times as likely to have another infection, showing that there is a background problem with immune response. [2]

So, how does our **immunity function**? We've got two systems, one built upon the other.

The very oldest system is **innate**. It is primitive, the **first line of defense**, and it is not improved by infection. There is evidence of this system alone, in animals, before they crawled out of the primeval slime and began to live on land. After that time, life became much more difficult, and animals needed to adapt and develop a more sophisticated system. So, a second system was built on top of the first, and that is known as the **acquired immune system**. This is a **second line of defense**, and **it has two properties**: it **is specific and it has memory**. So, it is generally speaking improved by infection, and that is the whole basis of immunization and vaccination, to let you body see an organism, to start making this acquired response, so next time you meet it, you make a bigger, faster more accurate response, which deals with the organism very quickly.

Now what are the components of these systems? The **innate immune system** in the respiratory tract largely **consists of the mucus and the cilia** which beat the mucus. And I think we are all aware that anybody who has problems with either mucus or cilia tends to have problems with rhinosinusitis For example children with cystic fibrosis or primary ciliary dyskinesia (PCD) have chronic running discharging noses, largely from birth.

There are **other innate immune factors**; interferon, lysozyme, defensins made by epithelial cells and the early types of phagocytes: the neutrophils and the macrophages.

There is also an interesting molecule which looks like an upside down bunch of flowers. It used to be called mannose binding **protein**. Recently the name has been changed to **mannose binding lectin** (MBL). And this has interesting properties: one end of binds to sugars, and the other end sticks on the neutrophils. This molecule **is important in attaching bacteria and fungi to white cells**, so that they can be ingested, and it is a very primitive one [3].

The reason for the interest in MBL is that it seems to be very important in early childhood, because small children don't have their full repertoire of antibodies. And one of the last antibodies to be made is IgG2 [2] which is the one that binds carbohydrate. Most bacteria that infect the respiratory tract, such as *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, all have carbohydrate outer coatings as a virulence factor, because those sugar coatings means that they can slide off the white cells quite easily. And MBL is an early adaptation of ours to try to hang on to those molecules, so the white cells can phagocytose the bacteria.

MBL contains polypeptide chains. Three polypeptide chains wound round each other in each of these legs. And just as in a haemoglobinopathy single amino-acid substitutions occur in some people. Single amino-acid substitutions restrict the ability of the polypeptide chains to fold round each other resulting in decreased synthesis of mannose binding lectin, and subsequent susceptibility to infection, especially early in life until IgG2 levels rise.

There is some dispute whether lacking MBL matters in adult life [3]. There is evidence that it may be relevant to certain infections, such as *Chlamydia sp* and it may be relevant to ischemic heart disease, you may be more susceptible to ischemic heart disease if you lack your full complement of mannose binding lectin.

Now I have mentioned mucus. We have heard about the full blown cystic fibrosis in homozygotes with 2 CF genes. But what about the carriers? We have often been told that the carriers are not abnormal. That may not be true. There are two papers, one in children, one in adults, suggesting that carriers for cystic fibrosis are over represented in the chronic rhinosinusitis population. This may be one factor that we need to take into consideration. They may have a minor defect in their mucociliary clearance which is just sufficient in that absurd anatomical situation that we have in our sinuses.

There are some other ideas. Some people cite the fact that **milk makes their mucous thick and stickier**. **There is no scientific evidence for that whatsoever**. But you can't stop mothers putting their children on to milk-free diets, I'm afraid.

What about the cilia themselves? I think you are all very much aware that you have cilia constantly beating while with a stiff-armed forward stroke and a limp-wristed backstroke, moving in a metachronistic fashion, like a Mexican wave at a ball game, moving the mucus onwards, clearing out your sinuses. **Abnormalities of ciliary motion** as a primary defect are rare: 1:10,000. Secondary problems with cilia, are incredibly common. There is a very, very **cheap test**. The cheapest test in ENT. Does anyone know what that particle is there? Yes, saccharine. **Saccharine test**. It is not very reliable but it can give you some idea. You put it beyond the squamous epithelia, on to the respiratory epithelia, at the beginning of the inferior turbinate and you see how long it takes for the patient to taste it, when it gets down to the back of the tongue. Normally it is less than 20 minutes, with a mean value of 10 to 12 minutes. If the saccharin test is abnormal or if you have a suspicion from the history of this child, who has had problems all its life you may want to go on and do some more detailed testing of ciliary structure.

The structure of the cilium, and it hasn't changed since the primitive organism paramecium, which gives you an idea, how important it is in an evolutionary context. There are the doublets: the outer ring, the two in the center, the radial spokes, and in primary ciliary dyskinesia (PCD) you can have abnormalities in any of these. There are outer and inner dynein arms, either or both of which can be absent. You also can have abnormalities in the mitochondria that power the cilia. In order to look for this you have to do electron-microscopy an in order to allow for processing artefacts, you really need to see roughly 60% of abnormal cilia in a sample. That takes time, energy and money. Jorissenin from Belgium has suggested that in order to do this properly, what we should be doing is taking cilia, and culturing them them for one or two weeks to get rid of secondary changes due to infection and then do this. Now, this is an incredibly expensive procedure. But we may have interesting help: **Nitric oxide (NO) levels measured**, in the chest and also in the nose. Now when you do that in patients with PCD what you find is that they have all got very low levels of nitric oxide in their noses, less than 100 in most of them. And that gives you a very good idea that they may well have PCD. Conversely, if you have got a patient that you think has PCD and they have nitric oxide levels above 250ppb nasally, you can forget about that expensive testing of ciliary structure.

Secondary problems with cilia are very common. **Pollution** (such as **tobacco smoke, traffic pollution**), **infection** and the **allergic reaction reduce ciliary beating**. Middle-ear effusions put on to cilia also reduce their beating. In an electron micrograph of a nasal epithelial cell, we have the cilia, sticking up the top (this is what happens in some upper respiratory tract viral infections) until a complete loss of all cilia. Small wonder that **viral colds are often followed by bacterial problems**.

Bacteria which attack the upper respiratory tract not only have have carbohydrate coats, many of them also produce molecules that adversely affect mucociliary clearance. If mucus is standing still, bacteria can latch on to the epithelial cell and cause an infection. Whereas if bacteria are trapped in mucus that is moving they are washed down to the stomach and destroyed by gastric acid.

There is a distinct improvement in ciliary beat frequency after a prolonged course of antibiotics [3]. This is actually an adult study, in some of these patients we could not initially detect any beating cilia in many of them the level was below normal and after antibiotics the levels all came into the normal range.

Now, that was the innate system. What about the **acquired**? This consists of **lymphocytes and the antibodies**. The lymphocytes are the **B lymphocytes** that **make the antibodies** and the and the **T lymphocytes that orchestrate the nature of the immune response**. Antibodies themselves come in five different classes: IgM the most primitive, pentameric one; IgG, the most commonest circulating one that has four subclasses; IgA the one that acts on mucosal surfaces; IgD is primitive and has no real function; and IgE that is responsible for allergy. Now if you look at which of these is important in the nose, IgA deficiency is probably relevant and it is a very common deficiency: 1 in roughly 500 people. Interestingly, only about half of those are troubled by recurrent infections. The half that aren't troubled, put out antibody IgM into their secretions, which appears to have the same functions. Those that are troubled, put out the functionless IgD molecule, and they get infections. Sometimes you will find total IgG lack – hypo gammaglobulin anemia – but sometimes you just find one of these G subclasses reduced, occasionally together with an IgA defect. And that is quite a common finding in the pediatric population. But it may not always be persistent; it can be a transient, maturational problem. So it is worthwhile just sending a sample of serum to the laboratory in a child with chronic rhinosinusitis and see whether this problem exists.

We also have a transient hypo gammaglobulin anemia. The patient, not too long after birth, with some maternal gammaglobulin, that drops off quite rapidly by about 6 months; but it is not until about 18 months that the child starts being able to manufacture its own gammaglobulin G and comes up into the normal range. During the time when levels are low that child is likely to suffer from upper and possibly lower respiratory tract problems

Transient IgA deficiency can persist up until the age of 12 This is what IgA looks like: it is two antibody molecules, back to back, joined by a J-chain, with secretory component wrapped round it so it is protected from digestion. And these are variable regions of the antibody, and these tend to combine with bacteria and some viruses to stop them from entering the mucosa, and the bacteria/IgA complex is

just washed away in the mucus.

Some children will recover from their problems simply by maturation of their immune system. Some will get immune deficiency, just because they are not getting enough to eat: not enough protein, maybe not enough Zinc, vitamin A. Some of them will be immune deficient because of infection – infections like measles reduce your T-Cell function as do mycobacterial infections. For some children the problem is doctors: we give them immunosuppressants such as oral steroids, we give them phenytoin for epilepsy, which reduces their IgA. Some will lack splenic function, and are very much more susceptible to carbohydrate-coated bacteria, especially if they are not given pneumococcal vaccination. Those with diabetes are more susceptible. Besides allergy and infection other conditions such as gastroesophageal reflux disorder may predispose to chronic rhinosinusitis. There are several studies, including a recent one from South America suggesting that in some CRS children the oesophageal pH is abnormal, and if you treat this the nasal problems improve.

I also mentioned that allergy might be relevant. I think you are all aware that allergy is a huge global problem. We have the ISAAC data, the International Study on Asthma and Allergies in Childhood, looking at seasonal allergic rhinitis – we call it hay fever – in 13 to 14 year olds. You can see how in many places, 10 to 20% of teenagers are affected by this.

If you look at the **pathophysiology of allergy**, there are **2 distinct phases**: there is the **mast cell degranulation** – the mast cells are coated with IgE, made by B-lymphocytes, at the behest of T Lymphocytes, to recognize allergen, and that is a fairly **immediate phenomenon**: subsequent to allergic contact, mast cell degranulation, **release of mediators and immediate symptoms**. Sneezing, itching, watery discharge and blockage. That is what I call obvious allergy. Everybody can recognize it. The patient knows what is wrong with him. The patient can probably tell you what the allergen is as well.

What people don't recognize as allergy is the **late phase**. This phase of the condition – much more common when you have got a chronic allergen around: **house dust mite**, the **mould**, the **cat that sleeps on the bed** – when you are on this phase it is largely the T cells and the cytokines that are responsible. They are calling up inflammatory cells. The cardinal cell is the eosinophil, but there are also more mast cells, more T lymphocytes some basophils. And you have a thicker lining, a chronic ongoing persistent rhinitis. And the major symptoms on this phase, are not so much itching, sneezing but blockage. And that thickening will not only involve the lining of the nose but the lining of the sinuses. Symptoms include hyposmia and irritability of that lining of the nose: the nose will run when it goes into a cold environment, it will run on exposure to perfume, smoke or dust. The allergy is not necessarily to any of those things. They are provoking a hyper reactivity. The allergy is to whatever is stimulating the immune response:it may be the cat, it may be mould, it may be cockroach.

But this can be misdiagnosed as vasomotor rhinitis, because of the hyper reactivity.

And if we look at the recent **classification of rhinitis** according to the

ARIA guidelines [5] (ARIA is Allergic Rhinitis and its Impact on Asthma) it has been reclassified as either **intermittent** or **persistent**. And **intermittent** goes very much with **mast cell degranulation** with **lots of symptoms** like itching, sneezing, secretion, eye symptoms, occasional chronic rhinosinusitis. And then you look at the **persistent**, **late phase of rhinitis**. Chronic sinusitis is frequent, asthma is common, smell disturbance is common, and obstruction is usually present.

In the normal nose, secretions are moved up by the mucociliary clearance, out into the ostiomeatal complex, and away. We have the allergic nose, thickened, bulgy lining, thickened eosinophil secretions, ostiomeatal complex blocked by the thickened mucosa. And even though an enterprising ENT surgeon has attempted an inferior meatal antrostomy it is not working because mucociliary clearance is still driving mucus towards the ostiomeatal complex. And there is some dispute about **the role of allergy in infection**. But I think that the mucosal edema, the fact that allergy increases ICAM-1 which is the rhinovirus receptor, and rhinovirus is responsible for between one third and one half of colds – that may also be relevant – we have shown that allergy decreases mucociliary clearance using a house dust mite challenge model, and the eosinophils can be very, very damaging to the mucosa, they contain remarkably potent molecules that damage epithelial cells.

So what about the child with chronic rhinosinusitis. What do you do? Well, first of all you **take a history**. You want to know for how long they have had the problem.

If it goes right back to near birth, it is almost certainly some significant innate component going wrong. Especially if that child is failing to thrive and grow properly. You want to know whether it is totally continuous or intermittent. If there are spaces where the whole thing gets better, then it is unlikely that the child has something like PCD. You want to know their past history, if they developed chronic rhinosinusitis in recent years did they have asthma, or atopic dermatitis at birth do they have asthma, if it is an atopic child. Is there a family history of atopy? Or a family history of chronic sinusitis or cystic fibrosis in the family? Do the parents smoke? How many parents smoke in the house? Does the child go to nursery and mixes with lots of other children and keeps catching colds?

In treatment, what have they used? Did they actually use it? And **how** did they use it? Because **many people put in nasal sprays totally wrong**. They put them in with their heads back and sniff hard. So all the spray just gets taken straight back and goes down the throat. And then, there is another child. Before you put in the endoscope, before you do anything else just look at the child. There is that allergic horizontal crease. This child, can't breathe through his nose, he can't shut his mouth. He has got facial eczema. In fact he has got eczema all over, and he has also got some very fine veins on his face due to prolonged use of cortico-steroids. This is a highly atopic child. So atopy may well be playing a part in this child's problems.

And then, of course, there are more sophisticated things you can do. Look up the nose either with an otoscope or if the child is old enough and will let you, use the **endoscope**. You may want to take **swabs**. You may need **CT scans**. Certainly

this is not a first line test. You might well want to do **skin prick test**, you might want to take blood tests looking for **immune deficiency**. And if you have got a nitric oxide analyzer it makes good sense to measure that. Maybe a **saccharine test**. Maybe **check their immunity**, their **vaccination history** and whether they **respond to *Streptococcus pneumoniae* and tetanus**. If you look up the nose and see a **polyp**, **think of cystic fibrosis**.

Do you need **ordinary X rays**? Almost certainly **not**. 45% of patients with normal plain X rays have abnormal **CT scans**. Conversely, 34% of patients with abnormal plain X rays have a normal CT scans. Most children do not need radiological investigation unless they fail medical therapy – in that case a CT scan could be considered.

But certainly, in many children it is worth **taking a history** and then consider doing some **skin prick testing**. We will skin prick test children of any age, we tend to skin prick test smaller children on their back, when they are cuddling up close to mom and they really don't mind. And we rarely have any problem with it. And provided you include a negative control saline, and positive control histamine, and record the results and see whether they relate to the history, then you may well find out very useful things, such as; a big reaction to house dust mite, or the child living in a hostile environment, with five other people, see if the mattress is on the floor. Difficult to do anything about it but at least you know where it is coming from.

And then on to **treatment**. The first thing is to **try and avoid the simple things that are precipitating the problem**. The allergens: house dust mite, get the cat out of the bed, get the bird out of the house, ask the parents to stop smoking if you can. If they live next to a busy road there is not a lot you can do, apart from keeping the window shut. And then other factors. If you think it is **reflux** you may try to treat that. Third on this list I put something that is extremely simple; and it is one of the few things for which there is evidence, and that is douching [4]. **Nasal irrigation** improves symptom scores, improves quality of life, but sadly we weren't able to show any effect on the airway itself, or on mucociliary clearance. There are a couple of other papers that show similar things. And you can buy saline sprays, tiny ones, gentle ones for babies, stronger ones for older children. And douching morning and night does seem to make a difference to this condition, even to PCD. Simple, saline douching. Some people prefer to have it isotonic, some hypotonic, but it works, and it is worth trying and it is cheap.

And I have mentioned ARIA – Allergic Rhinitis and its Impact on Asthma, a World Health Organization doctrine that came out on 2001, and that gives you a scheme for treating rhinitis [5]. For anything more than a **mild rhinitis the treatment of choice is a intranasal steroid**.

Now, people tend to think about antihistamines in children rather than steroids. There is a paper of ours recently published on PAI [6] where we compared on a double blind, double dummy basis, fluticasone propionate nasal spray (Flixonase) to the antihistamine ketotifen. We found that Flixonase was better, with more children recording substantial improvement compared to the antihistamine.

And there is another recent paper, this is an adult paper that shows that in acute

rhinosinusitis, the addition of mometasone to the antibiotic results, in two different studies, in greater improvement, from day 6 onwards. So, even in the acute infective situation, you can use topical **nasal steroid** in the nose with benefit, presumably because it helps to take away quite a lot of that swelling, possibly because it helps to improve mucociliary clearance.

Now, we need to **be careful with steroids**, **even nasal steroids**, because as you well know they can have significant adverse effects. There is one betamethasone drops available in United Kingdom (UK) known as Betnesol that is extremely effective, but 100% absorbed, there are at least three reports in the literature of Cushing's syndrome or reduce cortisone response to ACTH following prolonged use Betnesol drops and dexamethasone sprays cannot be used long-term in children. You may want to start them off for a few days, because they are highly effective, but they are not for long-term use. Even the second generation of steroids, such as budesonide, flunisolide, beclamethasone dipropionate (BDP), have some systemic bioavailability. Short-term use seems to be fine, once daily use is probably all right, but not long-term use. If you have a child with a long-term problem use fluticasone or mometasone, which are least absorbed. And it makes sense to **monitor the child's growth**. Growth in childhood is a very sensitive indicator of steroid absorption and steroid side effects.

What about **antibiotics**?

I have said that some of these cases are predominantly infective. Should we be using antibiotics in chronic rhinosinusitis? Most people will use them in short-term for acute infective exacerbations. The Japanese, however, have got some interesting experiences with macrolides, They have a condition there called diffuse pan bronchiolitis, which can be fatal. And they found that erythromycin works against this problem, increasing the 5-year survival from 42 to 80%. This is in adults. This occurred even if the micro-organism cultured from the chest was not erythromycin-sensitive [7]. They noticed as well that these adults tended to have chronic rhinosinusitis, but when they took the erythromycin, that improved too. They go on to show clarithromycin has similar properties. This was a 12-week study and the effect was increasing by the 12th week, again suggesting that this is not being used as an antibiotics but may some other kind of effect.

There was one study in children which suggested that antibiotic alone did not work and that anti-histamines were also needed. Now, these studies have all been heavily criticized because they are open studies. We need some proper evidence-base for this approach. Sameh Ragab, Valerie Lund and I have just finished an adult study which is now published in Laryngoscope [8] using erythromycin for adult chronic rhinosinusitis as a medical modality of treatment and comparing it to surgery [7]. And medicine is just as good as surgery. We are taking part in a pan European study now of Azithromycin. And the macrolides do appear to have properties of an anti-inflammatory nature that may well be relevant to CSR therapy.

Now **Surgery**. Do we need surgery? Very few places still do antral puncture / sinus washout, simply because once you have done it the organisms will grow

back again and you are not really treating the underlying cause. **Endoscopic sinus surgery** acts around the osteomeatal complex, and may well be useful. Also, adenoidectomy and tonsillectomy have been suggested. And in 1999, Peter Clement led a group including myself that looked at the indications for endoscopic sinus surgery and came up with the fact that there were absolute indications: severe complications, mucocoele symptoms, systemic complications and we suggested that **after six months of failed medical treatment for recurrent rhinosinusitis then you might consider surgery** [9].

What about adeno-tonsillectomy?

There is a very recent meta-analysis, including 6 randomized and 7 non-randomized trials, giving 1596 person-years data on upper respiratory tract infections, and it shows the difference following operation was half an episode a year, with a confidence interval of minus 0.7 to minus 0.3. So you lose half an episode of infection on your upper respiratory tract per year. It is not very effective. I also worry a little bit about operating on small noses, as I am sure you do. I have 2 patients, a pair of twins and one twin had an injury to his nasal septum, and did surgery and no longer looks like Leonardo di Caprio. You do have to be careful about mid facial growth when you operate on a pediatric nose.

Now, what I have said in my chapter is related to the nose and the sinuses. But **the nose is the gateway to the whole respiratory tract**. And once you have **nasal problems** you may have knock-on problems, **not only affecting the sinuses**, but **also affecting the middle ear**, and practically all I have said here could equally well be **applied to otitis media**, **acute otitis media** and **otitis media with effusion**, particularly. And also, **you will have effects on the lower respiratory tract**, **if you have problems with the nose**. And remember the nasal hyper reactivity, the twitchy nasal airway you get with chronic rhinitis? Well, you also get a twitchy airway, in the lower respiratory tract. And there are one or two papers suggesting that children who have been treated for **asthma** were in fact suffering only from **rhinosinusitis**.So remember, if your have patients with any of these problems, always look at the nose which maybe where the problem originates.

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