

[MUSIC PLAYING]

MALE SPEAKER: Today, we're going to be discussing breathing. Sinonasal and allergies primarily. I wanted to take a few moments to thank all the members of our E&E allergy team here at UPMC.

Starting from our medical assistants, nurses, physician assistants, and even other physicians who participate in the care of these patients within our department. Dr. Hathaway is the director of the allergy program and has worked really hard over the last year or so to revitalize the program, revamp things. And there's some really exciting things ahead.

This is an image of probably what many imagine when you think of this wonderful city Pittsburgh during the spring. With trees and beautiful flowering bulbs, but unfortunately these come to cause some bothersome allergy symptoms for a lot of individuals. My goal in the next 30 minutes or so is to share our approach to allergies as otolaryngologists.

And during this discussion, highlight specific research discoveries that the faculty in this department have made, really, thanks to the generous support of the Eye & Ear Foundation and you all who are here today.

A few of my housekeeping points. I'm going to be discussing several brand-name medications. I don't have any affiliation with any of these companies, no financial or intellectual conflicts of interest to disclose. I'm a member of the American Academy of Otolaryngology. Abbreviated AAOA.

And this is really one of the major educators in our specialty. And I owe a lot of my knowledge, aside from my residency training, to this great organization. The concept of sinusitis is a highly prevalent concept in medical documentation and patients' minds, but it's really something that's not as accurately diagnosed as we would like. Just because it is such a tricky subject.

When it comes to chronic rhinitis, which is really a catch all umbrella term, we typically try to separate this into three different ideologies, which all overlap. And that being allergic, infectious, and non allergic causes.

The challenge that we face as clinicians is that there's a significant amount of overlap like I mentioned. And it really comes down to the diagnostic workup, which includes taking a look in the nose with a camera, which is a nasal endoscopy. We can do that in the office or allergy testing once you have done a pretty thorough history.

The focus of today's talk is going to be allergic rhinitis. So really focusing at the top of that Venn diagram that you see there. And I encourage everyone who didn't get a chance to see it live to take a look at Doctor Eric Wong's talk discussing nasal obstruction and chronic rhinosinusitis on the Eye & Ear website.

He gives a fantastic overview of those topics. So allergic rhinitis, which we commonly refer to as allergies, is one of the most common diseases affecting adults. It is the most common chronic disease in children in the US. And the fifth most common chronic disease overall.

It affects nearly one in six Americans and generates \$2 to \$5 billion in health expenditures annually. And it's got a significant quality of life impairment through a combination across of work and school attendance, and decreased productivity. And that accounts for \$2 to \$4 billion per year.

How we define allergic rhinitis is a bit tricky because we have our medical definition, which is inflammatory antibody mediated disease. Characterized by the symptoms that you see there. Some nasal congestion or nasal drainage. Sneezing, itching, and eye symptoms, which can include swelling, redness, and watering.

We classify allergic rhinitis in several different ways. So the first can be based on a temporal pattern of symptoms. So, you can have seasonal symptoms from pollens or perennial symptoms from dust mites. Or even episodic symptoms from environmental exposures that are not normally encountered.

For instance, if you don't have a pet and you go over to a friend's house or a family member's house and they have a pet, that would be an episodic environmental exposure. Another descriptor that we can use is how frequent a patient gets symptoms. This can be divided into intermittent symptoms, which is less than 4 days per week or less than four weeks per year.

Or the converse of that being persistent, which is greater than 4 days per week or greater than 4 weeks per year. Lastly, we can separate patients into severity of symptoms. So this is subdivided into mild, which are symptoms that don't affect quality of life or really have a big interference with quality of life. Or severe symptoms, which is when symptoms are bad enough to interfere with quality of life.

Clearly, none of these methods to classify allergic symptoms are perfect. And in clinical practice we're really using a combination of this. There's a few interesting topics within just the 50,000 foot view of allergies that are interesting to me. And I think interesting to most people as well.

The first being something called the atopic march, or progression with age. So there's been plenty of cross-sectional and longitudinal studies that indicate that allergic disease occurs in a time based or age based order. From eczema and atopic dermatitis and food allergies in infancy, to the gradual development of early allergic asthma in early childhood.

And you can see that in the green line once the blue and the red start to tail off. And then, this is followed by allergic rhinitis in grade school children, which usually persists into adulthood. And that's demonstrated there by the orange line on the graph.

There's also a number of comorbid conditions that we see. Such as chronic sinusitis and laryngeal pharyngeal reflux or GERD is a common abbreviation that you'll see. And a lot of these are associated with allergic rhinitis.

And we have this term that we use called the unified airway theory. And I'm up the perspective that as an otolaryngologist, we're perfectly suited to diagnose and also manage a lot of these overlapping conditions.

At the head of a multidisciplinary team between pulmonary gastroenterology and immunology or infectious disease. Another interesting concept is the hygiene hypothesis. If this was an in-person lecture or discussion, this is when I would ask for some audience participation, but since we're doing this through Zoom.

Really, what is the hygiene hypothesis. It states that in early childhood, exposure to particular micro-organisms protects against allergic disease by contributing to the development of the immune system. And in particular, lack of exposure is thought to lead to defects in the establishment of immune tolerance.

It really boils down to does growing up on a farm versus growing up in a city in really clean environment, does that make a difference? And we're really thinking it does. And that's part of the reason why allergies are so common today.

As we go through this discussion of allergies and the whole gamut of what the options are, I'm going to try to highlight some of the research that's been done in this department. This was a publication from the early 2000s by Dr. Ferguson. And she published her work on the influence of allergy symptoms and what role that plays on sleep. And

As you can see on the right side of the screen, they looked at four symptoms. Sneezing, blocked nose, runny nose and itchy nose. And they tracked these symptoms over time and they had patients grade their symptoms. And what they found was that symptoms were most severe in the morning.

At that time of around 6:00 in the morning. And these really increased from that midnight to 6:00 AM time period. And it's believed to be that it's a combination of laying flat and variations in the circadian rhythm that caused these symptoms. And it's so classic that allergy patients have symptoms worse in the morning. And Dr. Ferguson was really instrumental in improving this.

So a little bit about the immune system. And not to get bogged down in details, but we can separate the immune system into innate immunity and adaptive immunity. And part of the innate immune system are the physical barriers that our body has.

So part of that being the skin, the mucous membranes of the mouth and the GI tract and even the stomach acid that we have. That's part of what protects us. And the goal of the immune system is to provide surveillance and protect us. But we also want to get some memory if we're exposed to a virus or bacteria in future.

When you look at the cellular level in the blood, you can separate the immune system into innate immunity. Which are cells that respond to antigens just based on what they've been programmed to do. Versus adaptive immunity. Which is more of a learned response through antibody production and having memory to what they've been exposed to in the past.

And with these immune factors, it really becomes important that there's an equilibrium. And that's the balance between tolerance and response. As I mentioned, the immune system is critical to fight off pathogens that we encounter, but it's also critical to tolerating ourselves. And this is a really fine balance that can get thrown off when we're encountering so many things just throughout the normal day.

And if you're looking at this diagram, if you get thrown off anywhere, that's where you can develop disease. And if you're starting from the top right working clockwise, if that ability to tolerate your environment gets thrown off, that leads to allergic disease. If that ability to respond to a pathogen gets thrown off, that leads to infectious diseases and infections.

If the ability to respond to cancerous cells gets thrown off that leads to cancer. And the ability to tolerate yourself if that gets thrown off that leads to autoimmune conditions. So it's this really fine balance that needs to work really in perfect harmony.

In the early 2000s, a landmark paper came out in the New England Journal of Medicine. And the details are really beyond the scope of this talk. But they started looking at how all of these factors and interleukin's, which are chemicals that these cells produce, how they all interact. And they really started to be able to isolate these different immune cells which contribute to allergy symptoms.

Another interesting subject within allergic rhinitis and that's related to something called oral allergy syndrome, which a lot of people may say, hey, I actually get some of these symptoms. But to just give it a little introduction to this, this is a 3D comparison of the proteins from apples compared to celery. And these were compared to birch pollen.

It's sort of a strange relationship, but if you look at all the areas that are bright right here, looking at the surface structure of these proteins, the red areas are the areas that are the regions of the protein that are conserved. And given that there is a lot of structural similarity between birch pollen, there is an association that people with birch pollen allergy are also more likely to be allergic to apples, and also, less so to celery.

So it's this cross reactivity between inhaled allergens and food cross-reactivity. And it has implications on symptoms that can change based on the pollen that's in the air and the food that you're eating.

We have a chart that we discuss with patients in certain situations. But these associations with birch are typically apple, celery, carrots, zucchini, hazelnut, pear, peach, plum, cherry, strawberry, orange. And there's others where patients that have allergies to grass can also have associated food sensitivities to tomatoes, peanuts, kiwi, wheat, rye, apple and carrot.

Also, for ragweed, it's typically melons and banana. The interesting part about this is, a lot of patients get symptoms if they eat raw foods, but if they're eating cooked apples and they have the birch allergy it really isn't an issue because the protein gets denatured. So just another interesting thing to discuss within allergies.

To start focusing on really what causes allergies. We separate this into indoor inhaled allergens and outdoor. The most common indoor allergens that we see around us are dust mites. And it's really the dust mite feces, which is the most allergenic component.

Another common one is mold spores that you'll see indoors. Cockroach and pet dander. Especially cat saliva. That's really one of the most allergenic things that we encounter.

When it comes to outdoor allergens, mold spores are also found outdoors as well, but we typically think about these with a seasonal relationship. So trees being most common in spring, grasses that flower most common in the summer, weeds and the associated pollen most common in the fall, and molds really are seen year round.

Shifting gears and now focusing on what we can do for patients with allergies. We think about it as a ladder. And we like to do it in a step wise approach and try to give each step along the way a good shot.

Starting at the bottom, our goal overall is symptom control. And it would make sense that if you could avoid something that triggers your symptoms or employ an environmental control strategy, that would make sense. And that's a good theoretical option.

We're going to go through some of those. But in actuality, there's not a lot of data to support that this is a very robust measure. Medications or pharmacotherapy would be another good option and really the next step up. But the issue with medication, there is no exit strategy.

So a lot of these can be lifelong medications and that creates a bit of anxiety for a lot of patients. And really, the last option, or the top of that ladder would be something that we call immunotherapy. Or allergy shots, or sublingual drops. And really, that's the only option with hopes of mitigating allergy symptoms from addressing the root of the issue or curing symptoms.

Within the otolaryngology community, we have some really landmark clinical practice guidelines. One that was released by the American Academy of Otolaryngology. Discussing allergic rhinitis.

And then a few years after that, there was an international consensus statement, also on allergic rhinitis. And a lot of our most robust recommendations come from these two landmark works. The first part of this ladder that we're going to discuss is avoidance. And like I mentioned, this is a good theoretical option.

So, the 50,000 foot view of environmental control. And the approach that we take is that the options are removing the subject from the allergen environment. Or trying to reduce the allergen in a subject's environment. Or lastly, trying to prevent such sensitization before an allergy develops.

And a lot of that has to do with pediatrics. And they're doing a lot of research in regards to this, but it becomes a very complicated discussion. Some interesting points that a lot of people with allergies bring up is that many patients benefit when they go on vacation and they're really, away from that inhaled allergen exposure.

And this has been more difficult in COVID times, but that's what a lot of patients with allergies report. And there's also been some interesting work for kids that had to be moved for one reason or another, but they were moved from a sea level climate to a high altitude area. And that really made a big difference in their allergy symptoms, especially if they had comorbid asthma and the airway reactivity.

So there is definitely a role that altitude plays because that changes what the allergens are. Going back to in the clinical practice guidelines, they grade their recommendations. Either a strong recommendation, or an option, or strongly disagree.

And when it comes to environmental controls, they word it as the clinician may advise avoidance of known allergens. Because really, it's hard to present this as a strong recommendation just with the limited data that we have.

So some techniques to reduce allergens. The first being an impermeable mattress cover. A lot of you have probably seen this. But the theory is, that if you can just cover up a mattress or a box spring or pillow, that you can reduce the dust mite counts because the skin cells aren't able to get to the dust mites. And that's what they feed on.

There's definitely a significant reduction in the allergen load, but this doesn't always hold up after several weeks. Another option is washing bedding in hot water greater than 130 degrees. That's an effective way to reduce dust mites.

Dehumidifiers in the house have been somewhat effective, at least in the short term. Air conditioners or central dehumidifiers can also help, but really the goal is to get the humidity to less than 50%. Acaricide is basically a general term for pesticides, which is a chemical that can be used in the house to reduce dust mites up to 70% to 90%.

Really, this is the single most effective measure for dust mites, specifically. And this was proven in a 2010 Cochrane review. It just becomes a little bit tricky because some of these chemicals, for instance, tannic acid can stain furniture if not used correctly. So it can scare off a lot of patients.

Vacuuming alone hasn't been shown to be effective, but some vacuums with HEPA filters have shown some benefit at least. And then other measures, like reducing curtains, carpets, fabrics and upholstery. Introducing sunlight. All have shown to have some benefits.

Looking at specific allergens. Dust mites are really one of the most common things that we encounter. Most commonly found in the bedroom. Involving pillows, mattresses, box springs.

These are really, really tiny microscopic insects that feed off skin cells. And we react to their fecal material. And there's shocking statistics that people have put out there, but a full sized bed can have over 2 million dust mites and 20% of the weight of a standard pillow can actually be from the dust mites.

I listed some of the physical measures here that are most effective that we covered on the previous slide. And like I mentioned, acaricides or pesticides really are the most effective measure proven in the literature. And there's been some benefit with the other measures that are listed here, but it comes down to that reducing the number of dust mites doesn't always reduce the symptoms in the long term.

Cockroaches are unfortunately something that's found commonly in urban environments, in older homes. There's been some association with lower socioeconomic settings, but they can also be found in old homes. And they're really more prevalent than most people are willing to admit.

It's been traditionally very difficult to control cockroach infestations. But some measures that have been partially effective in improving symptoms are insecticide, bait traps, house cleanings and extermination. But obviously there's a lot of cost and work that goes into this.

We know that 2/3 of houses have pets. Like I mentioned, it's the pet dander. But the most allergic or what most people have the high sensitivity to is really the cat saliva and its protein called Fel d 1.

And there's been some research out there that shows even once a cat has been removed from a house, or if you move into a house where the cat has been, can take up to four to six months for that cat dander and allergens to be removed with active cleaning and even treatments. Overall we find that fewer people develop allergies to dogs, but it's also very common. If complete avoidance isn't possible, because most people when you bring up the subject, aren't willing to get rid of their pet.

There's some strategies that we typically employ. That being trying to keep the pet out of the bedroom, or at least off of the bed. That definitely has to be the minimum. Trying to remove carpeting when possible because that can trap a lot of the antigen. But this can be expensive or out of budget for most patients.

Those acaricides that I mentioned can help to chemically denature the allergenic material. And even HEPA filters can be helpful. Really, the take-home message from these environmental controls that I want everyone to try to take away from is that, a lot of this has to come down to the patient preference.

Because that's who is ultimately going to be planning these environmental controls. And it has to be a shared decision between the physician and the patient to try to employ some strategies that really are the best options for them. So, what's practical. What is within the budget when it comes to cost, because some of these devices like HEPA filters can be pretty expensive.

Some can require multiple treatments like terminations and renovations are exceedingly expensive. To put in hardwood floors and remove carpet, that's a lot of work that you're talking about. Most people aren't able to do that. And there's a lot of research that's been done. It's really been done on asthma more so than the allergy type symptoms. So we don't have a ton of data about allergies and environmental controls.

Taking that next step up on the ladder. Next would come medications. And that comes down to nasal sprays and allergy pills. A lot of them are over the counter. There are still some that we're only able to get through prescription. And this gives us the best immediate benefit, but there's really no great exit strategy when it comes to these.

So our first line medications that many of you are probably familiar with is a topical nasal steroid. Or Flonase or fluticasone. This can be over-the-counter or prescription. It really is the same thing.

And there's plenty of different steroids that are also nasal sprays, not just fluticasone. Mometasone. There's a whole range of different options and they all work by the same mechanism.

The next option that we consider in our first line of treatment would be an oral antihistamine. And there is a few different options that are non-drowsy. But they have varying levels of sedation that some of them can have.

So the one with least sedating qualities is Allegra, but there's other options, such as Claritin or Zyrtec. All pretty similar. They have different onset of action in terms of how quick they act, but they all have the same general effect.

Another option is a medication called Azelastine. It is a nasal spray. And it's a topical antihistamine. And the FDA actually in 2021 approved this for non-prescription use.

It's not available in most pharmacies yet, but that's probably something that you're going to see over the counter. Topical antihistamine spray. One downside is it doesn't have a great taste. And that can bother a lot of patients.

And the last is a Neti Pot, or saline rinses. There are some that are mechanical and electronic that really rinse out the nose. Or it's the old-fashioned squeeze bottle. Or the Neti Pot where you're turning the head.

The squeeze bottle is what I found works best for most patients. Where you spray in one side of the nose and it comes out the mouth. And the theory here is that you rinse the nose out to clear out the allergens and it can be a good way to clean the nose prior to using one, or even two nasal sprays. Sometimes multiple times per day.

Other options for allergies that most of you are probably familiar with are some of the medications that are listed here. A very common one previously was Singulair. The FDA came out with a Black Box Warning about some psychiatric side effects, such as aggression, depression, agitation, sleep disturbances.

This was a few years ago about Singulair. So really it's not our first line option for allergies anymore. It can help if there's some associated lung symptoms or asthma, but it's not a great first line option for allergic rhinitis.

Oral decongestants can be used for short term to help with symptoms, but it's really not the long term answer. So you're talking something about pseudoephedrine. The reason why we don't like it long term is that it doesn't treat the underlying issue. And there's side effects such as insomnia or changes in blood pressure. So that's really why it's not the long term option here.

There's another nasal spray that acts in a different way. It's called NasalCrom. And it stabilizes mast cells. And the goal is to prevent the release of histamine. Some patients get benefit from this, but again not a first line option.

And another nasal spray, that's also a medication for the lungs, is Atrovent. And this is a medication that we use for rhinorrhea or a lot of mucus in the nose. And it really works to just decrease mucus production in nose and can cause too much dryness in some patients.

Medications that we don't recommend for allergies, at least in the long term, are oral steroids such as prednisone because of the risk of side effects. Insomnia, mood changes, and can affect your bone health with long term use.

Kenalog is an injectable steroid that some were previously using to inject into the turbinates in the nose. Again, not one of the medications that we're really recommending at this point. And the last being ephrin.

A really strong decongestant. The generic name is oxymetazoline. There's other nasal sprays that contain the same medication called Sinex that you can find over the counter. And the issue with long term use is this can cause rebound swelling. Making symptoms of nasal congestion even worse.

So what's most interesting about allergies is immunotherapy. And this is the top of the ladder. And this gives us our only chance for cure.

The goal with immunotherapy or allergy shots or drops is to create a tolerance within the immune system. And this can control symptoms, reduce medication use, and also reduce reactions that you get when you're exposed to these allergens. And in patients who have severe symptoms, that develop issues with the lungs or difficulty breathing, this can be really helpful for the highly allergic patient.

There are definitely some logistical challenges with this. And I'll cover some of these. But the symptom control really depends on the dose of the allergy shot that you're able to get to. And it requires continuous treatment. Generally for three to five years. And if you're not able to get to that full dose treatment and stay there for a few years, that early withdrawal decreases the effectiveness and the symptom control.

Before you get to allergy shots, though, you have to do allergy testing. And a lot of us have probably seen pictures, but while though you can separate this into two different categories. You can do skin testing or you can do blood testing. Skin testing has been around for essentially a century now.

And what it can involve is skin prick testing, like you're seeing here. Where it's either done one at a time or with a multi prick applicator, where the tester is able to do eight pricks at a time. Usually, you test for anywhere from 30 to 40 different sensitivities.

There's another option, which isn't done as commonly anymore, called intradermal testing. Where you inject varying concentrations of allergens and then you watch the response, you measure the response. And then you do this sequentially. You become more and more concentrated until you reach what you think will be the treatment dose. Or there's something called modified quantitative testing, which is a combination of both of those.

And then the other option would be blood testing. And what that involves is usually a tube of blood that's drawn in the office or at Quest. And there was a test in the past that was called the RAST. But there's now newer techniques that really were getting very similar results to skin prick testing.

So obviously providers have their own preference, but both of these provide very equivalent data. And I'm going to show you a study that was done in this department that really proved that. When it comes to treatment options, you can subdivide things into allergy shots or sublingual drops.

There's also newer treatments that are coming out, but a little bit beyond the scope of this. And this is really the only intervention to date which has the potential to cure a person of their allergies. And there's some literature in children that shows that allergy shots have the ability to improve symptoms and sensitivities from ever developing.

So the way this works is, there's a build up phase when you're doing allergy shots. And this depends on how sensitive the patient is, but there's a slow advancement over the first four to six months where the dose goes up leaning your way. You continue at this highest dose which we call maintenance.

And you continue this one time a week for at least a year, this maintenance dose. And then when you get to your second year, you can space things out to every two weeks. When you get to the third year of maintenance you can space things out to every three weeks. And after three years, that's generally when you've reached your maximum benefit and you start to think about stopping allergy shots.

Many will have no symptoms after stopping, but it's always possible to develop symptoms years later. And by testing we can tell whether a patient is highly allergic to an allergen or just slightly allergic. So that's how we guide where are we going to start treatment.

When it comes to sublingual, which we abbreviate as SLIT. S, L, I, T. Sublingual immunotherapy. This is an alternative means to treat allergies without injections. And there's always a pros and cons discussion that we have with patients.

But essentially this is a small dose under the tongue to boost tolerance to the substance and to reduce symptoms. Again, it's daily therapy. And you do this at home. The first dose is given in the office to make sure there's not a severe reaction.

And the goal is to reach maintenance. It's not technically FDA approved, so it's still considered an off label use and not covered by insurance. So there's definitely some cost consideration that goes into this.

There are some local and mild reactions, which more commonly occur early in treatment. But then the dose is adjusted and most patients do just fine. And there's some literature out there to show that the sublingual drops are just a little bit safer than allergy shots, but also show you that allergy shots-- it's very, very rare to get a reaction that is a very life-threatening.

In 2018 there was a study published by our department that showed looking prospectively and retrospectively at 177 patients undergoing allergy testing and treatment. And what they found was that there really was no difference in getting to maintenance. They called it time to maintenance.

So getting to that maximal dose that you need to continue, based on whether patients underwent blood testing or skin prick allergy testing, there were some shortening with that modality that's called intradermal testing, which is not commonly done. So really, there isn't a huge difference between blood testing and skin prick testing. And they also demonstrated that there's not a correlation with symptom improvement in terms of how quickly you got to maintenance therapy.

There's some newer FDA approved sublingual tablets which you may or may not have heard about. And there's four on the market right now. The names are pretty witty, but there's GRASTEK, which is for timothy grass.

RAGWITEK for short ragweed. Oralair, which is a combination of several different pollens. Ryegrass, timothy, Kentucky bluegrass, among a few others. And ODACTRA, which is for the two most common dust mites that you'll see.

So those are the four FDA approved sublingual tablets. Rather than the sublingual drops, which is a formulation made in the office and the patient is sent home with a bottle, this is something that's sent from the pharmacy for the patient. And the first dose is given in the office to make sure that there's not a reaction.

And this is something that's continued on a daily basis. And the patient takes it at the same time at home every day. All of these are approved for adults ages 18 to 65.

And two of them, GRASTEK, has been approved for kids down to age 5. And Oralair has been approved for kids down to age 10. There are some contraindications. And I'll also talk about the contraindications of allergy shots and drops.

But a few of these being severe unstable or uncontrolled asthma. A history of a severe reaction to allergy drops under the tongue in the past. A condition called eosinophilic esophagitis. And any allergy or hypersensitivity to the non active ingredients in these pills.

Any of those would preclude use of these. The risks of immunotherapy, they're pretty low. But the most common reaction that we see is swelling at the injection site. We do injections on the upper arm. So it can be some redness around the injection. Usually just a few millimeters, but very rarely, it spreads more than that and then we adjust things accordingly.

Typically occurs in the first 10 or 20 minutes of shot. But sometimes it takes longer than that. And this is why we have patients stay in the office for 30 minutes after injections. The most feared complication, which is exceedingly rare, is something called anaphylactic reaction.

And this includes that classic constellation of symptoms of shortness of breath, hives, wheezing, throat swelling. And it can be life threatening. Because that throat swelling can really affect the airway. It's less than 1 in a million reaction.

And most of these reactions occur in patients with severe or uncontrolled asthma. Or those patients who are on beta blockers. And that's a very special situation where epinephrine, which is your bail out treatment, doesn't work as well. So that's why allergy shots always have to be given under supervision and patients are kept in the office for observation after that.

Our department put out a paper about the safety of allergen immunotherapy. And this was a retrospective study looking at more than 1500 patients. And it looked at safety and areas where quality improvement could be done.

No one likes to admit their errors, but that's really how you learn. And in the care of 1500 patients, they only came up with a few instances where something went wrong. So, there were four times where there was a patient identification error.

Three times where the bile was inherent how it was mixed. And two instances in the incorrect dose being given. So that's pretty good if you think about the 1500s patients that were treated.

In these 1,500 patients that were treated there were only seven episodes of anaphylaxis, that very severe reaction. And that boils down to less than 0.01% or one in every 10,000 injections per year.

These are the contraindications. So we don't do allergy shots in these situations. In patients who use beta blockers for blood pressure control. Or any issues with the eyes.

A patient who can't take epinephrine. Patients who don't consistently show up for their allergy shots. That's not something that can be continued because if you're not showing up consistently, increases your chance for a reaction. Autoimmune conditions.

We continue allergy shots in pregnancy, but we don't start patients who are pregnant just because of the risks. Underlying asthma, like we talked about. And any other reason for the immune system being lowered.

We know with a lot of research out there, that allergy shots work. And the way they've proven it is, it helps with symptoms. So this is sustained symptom improvement in terms of symptoms going away, reducing the amount of nasal spray or allergy pills that you need to take, and the quality of life improvement that these patients get.

And there's also been a lot of objective data that has proven this as well. Changes in the immune system, new blocking antibodies that pop up after allergy shots have been performed that help to reduce the response to those very allergic sensitivities. Reduced skin reactivity in patients with asthma have shown a lot of benefit with their lung function after allergy shots.

In terms of our practice, it's currently used for facilities within our department. Mercy, Shadyside, Monroeville, Horizon. Doing allergy testing. So that's the skin prick testing. Allergy shots in the office.

So patients generally coming once a week. And that gets spaced out the longer that you're on treatment. Mixing the sublingual drops. That can be given under the tongue. First dose in the office. And subsequent doses given at home by the patient on a daily basis.

And also, starting patients on these FDA approved sublingual drops-- sublingual tablets, which are covered by insurance. So really, we have the whole gamut and there's a lot of providers that are involved with us.

So, really, to wrap up. I think as otolaryngologist, we're very fortunate to be in this position where when you think about the unified airway and everything that goes into allergies and all the comorbid conditions. Including chronic sinusitis, nasal polyps, reflux and these types of issues. We can really help patients get the right treatment that they needed.

And refer them to specialists that can help with other issues, like asthma. And it's really these treatment innovations and the research that helps to advance care that's supported by the Eye & Ear Foundation that's been really helpful for this. I wanted to thank you for taking the time to join us today. And I'm happy to answer any questions.