

Dr. Jason Barnes:

Hey there. Welcome to another episode of ENT in a Nutshell. My name's Jason Barnes and today, we're joined by rhinologist and skull base surgeon Dr. Sanjeet Rangarajan, and we will be discussing allergic fungal rhinosinusitis. Dr. Rangarajan, thanks so much for being here.

Dr. Sanjeet Rangarajan:

Hey, thanks for having me. This is going to be good.

Dr. Jason Barnes:

So I first wanted to start with presentation and there's kind of a specific geographic presentation which is why I'm excited to have you today. Can you tell us about the type of patient who presents to your clinic?

Dr. Sanjeet Rangarajan:

Yeah, certainly. So I think before I get into the details of how these patients present, it is important to note as you've alluded that I am located in the Southeastern United States in Tennessee and we see this type of patient much more frequently than in other parts of the country. So I do see allergic fungal patients that are both male and female. They do tend to be males more often. However, I do see plenty of females and people really of all ages. They tend to present a lot like regular chronic rhinosinusitis patients. So they'll come to you with very similar symptoms: nasal obstruction, facial pain, pressure, they can't smell, they can't taste. A couple of the ones that may give their diagnoses away may actually present with that they may be blowing out some kind of discolored or thick mucin. They may describe debris that comes out from their nose that they're having to blow out from time to time. Again, many of these patients are located in the Southeastern United States. However, I have seen them in the Midwest and Northeast during parts of my training as well.

Important to note that people with allergic fungal sinusitis are not the majority of our CRS cases. They do represent a minority, roughly 5% to 10%, and most importantly, it's important to distinguish these patients from those who are immunocompromised who may be presenting with a different type of fungal sinusitis, namely invasive fungal sinusitis. So these patients are presenting very similarly to your average CRS patient with maybe a couple of other symptoms that I mentioned. The last thing I'll mention, and this tends to happen in more advanced cases of AFS, but because again I'm in the South and I see a large number of these patients, I do occasionally get someone who comes in presenting with telecanthus or other alterations to their facial appearance or facial structure. Occasionally, there will be proptosis. These are the obviously advanced cases of allergic fungal sinusitis, but it's important to maintain a wide differential in order to properly diagnose these patients.

Dr. Jason Barnes:

Could you speak a little bit more to the epidemiology of this disease? Who are the types of patients, specifically the age that they present with, and are there any risk factors that you notice or that you ask about in clinic?

Dr. Sanjeet Rangarajan:

Yeah, so these patients tend to be on the younger side. It certainly doesn't exclude older individuals from having the disease, but they do tend to be younger, anywhere from the teenage years all the way up into their 20s, 30s, and 40s. We'll talk a little bit about the natural evolution and course of the

disease and why that tends to be. Potential other risk factors, this tends to present itself in more impoverished or people with lack of access to care. It can occur really in any racial group. However, traditionally African-Americans have also presented with the disease more often. Again, in the Southeastern United States, the disease doesn't necessarily discriminate between age and race, but it does tend to present more often in these demographics.

Dr. Jason Barnes:

And when you are seeing these patients in clinic, what are some more questions that you might be asking specifically for your HPI to tease out that this is allergic fungal versus something else?

Dr. Sanjeet Rangarajan:

Yeah. So like I mentioned especially in advanced cases, again those that are presenting with proptosis or things like that, I do think it's important to ask other screening questions to differentiate these patients from those who may be presenting with a tumor or malignancy. So important to ask questions like, "Are you having any pain? Are you having any numbness?" It's important to do a cranial nerve exam and make sure there's no cranial neuropathies. Extraocular eye movements are important to check, especially since advanced cases of allergic fungal sinusitis can extend and displace the orbit. Again, I ask questions about sense of smell and history of allergies. We'll note that allergic hypersensitivity plays a significant role in the pathogenesis of allergic fungal sinusitis, and so sometimes these patients will come in with either prior testing or knowledge that they are sensitive to certain [inaudible 00:05:34] allergens. Interestingly, it's interesting to note when patients move to a different geographic location, so for instance if they move from the North to the South, sometimes people don't develop these symptoms until after a move when they're changing their environment in some way.

Dr. Jason Barnes:

When you're seeing these patients in clinic, what does your physical exam look like? Are you regularly performing nasal endoscopy?

Dr. Sanjeet Rangarajan:

It's a great question. So again, because these patients are presenting with very similar symptoms to either something on the benign side like chronic rhinosinusitis, but on the other hand could have something more severe like a benign or malignant tumor, it's important to ask all of the questions that we've discussed, but when doing our physical exam, again we're paying very close attention to facial structure, contour of the orbit. We're asking, "Do you feel like your facial appearance has changed?" A complete head and neck exam is always important to perform and I do perform nasal endoscopy for these patients.

When I perform nasal endoscopy, I'm looking for a couple of key things. One, these patients will almost always have some amount of nasal polyposis and again in advanced cases, you're going to see this in the anterior nasal cavity extending sometimes into the nasopharynx. It'll obviously be filling the middle meatus, but polyposis is a big part of how these patients present. I'm also looking for the appearance of allergic mucin. We'll talk more about that, I'm sure, as we go through the podcast today. Allergic mucin tends to be very obvious. It's very thick and the mucin looks different from some of the other mucopurulent and other findings that we're used to associating with CRS.

Dr. Jason Barnes:

And yeah, moving onto pathophysiology, can you tell us what the etiology of this disease is?

Dr. Sanjeet Rangarajan:

Yeah, so it's really important to note how allergic fungal sinusitis differs from other fungal infections and also how it differs from chronic rhinosinusitis. I think the common misconception amongst patients and other physicians really that this is not a fungal infection of the sinuses. There are certainly fungi present in the sinuses and in the mucin, but what causes the issue is really a type two allergic inflammatory response against colonizing fungi that enter the sinonasal tract from a patient's environment. That kind of explains why this happens in some geographic regions compared to others. So again, this is a hypersensitivity reaction to the fungus that is creating a local tissue and inflammatory response. That is what starts the cycle that leads to allergic fungal sinusitis.

Dr. Jason Barnes:

As much as I try to avoid talking about the allergic pathways, could you tell us which pathway we're talking about here from an allergic and inflammation standpoint? What are some of the common fungi that are reported in these allergies?

Dr. Sanjeet Rangarajan:

Sure. Sure. So we'll just go through the key steps in how this occurs. The first is that fungal spores that are really circulating in the environment, in the air, they probably are in a lot of our noses in the Southeastern United States and they become trapped in the sinus mucosa in the mucus. That's the function of mucus, to trap these circulating materials. So in certain hosts or in certain patients, they become sensitized to these fungal antigens and the spores then generate hyphae which are the antigenic stimulus. So then there's this type two allergic response that leads to allergic inflammation much like it does with normal nasal polyposis, and then there's an eosinophilic response. We'll note later that these patients may present with elevated IGE as well as eosinophils, elevated tissue eosinophils.

So much like chronic rhinosinusitis, this type two response leads to damage to the sinonasal mucosa which then starts our cyclical pattern of damage to the sinus mucosa which is then unable to do its job, and then that's basically the pathways to polyposis are the same as for chronic rhinosinusitis. So there's numerous different fungi that are implicated to cause allergic fungal, and *Bipolaris*, *Curvularia*, *Aspergillus*, these are some of the more common fungi that are found. Bacterial infection can also occur in conjunction with allergic fungal sinusitis and interestingly as this cycle gets out of control and polyps are generated and this allergic mucin starts to develop, there can actually be erosion of the bone of the sinuses. So it's not uncommon for patients to present with eroded lamina papyracea or even in some severe situations, erosion of the skull base or the nasal bones. These are all possibilities with allergic fungal sinusitis.

Dr. Jason Barnes:

Yeah, and you're getting to one of the questions that I like to ask about natural history for this disease. In our CRS episode, we talked about the minimal risk of some complications like orbital abscesses and that kind of thing. With these patients, do you have a lower threshold to counsel them that the risk of complications is higher and therefore the need for intervention is probably a little more likely?

Dr. Sanjeet Rangarajan:

Yeah, absolutely. I think it's really important to, first, set expectations for patients in terms of what they can expect with either medical or surgical therapy which we'll get into later, but I do tell patients that ... I try to do it in simplistic terms. I tell them this is not your ordinary sinusitis. This is a chronic process

which has the potential to erode adjacent structures and without treatment, that they could have significant issues with vision, certainly obviously the sinonasal issues that come along with this disease, but also erosion of the bone of the cranial base and others.

I tell them that this is not a tumor per se. This is not a growth or a neoplasm, but in many ways, the process can sometimes act like one. So the same things that we expect with neoplasms, erosion and extension and pressure on certain adjacent vital structures, that can also occur here. I also tell them this is not the type of disease that necessary always gets better with medications, although that's certainly part of it, but I do stress that when patients see me for the first time, that we're together most likely for a long road that's going to involve several different treatment modalities.

Dr. Jason Barnes:

One last question for pathophysiology and pathogenesis. Could you speak to the laterality of this disease?

Dr. Sanjeet Rangarajan:

Yeah, it's a good question. So fungal sinusitis can present in several different ways. I mean you see it occasionally just unilateral involving one or two or three sinuses. In my opinion, there's somewhat of a spectrum of presentation. You see your maxillary or sphenoid mycetoma, but we're talking about a different process here. So this can present unilaterally although I will say that in my practice here in the South, I do see it very often bilaterally as well. Very rarely am I taking someone to the operating room just to do one side for their allergic fungal sinusitis, but this really can present in either way.

Dr. Jason Barnes:

And what else do you have on the differential diagnosis when a patient presents with the symptoms and history that we've been talking about?

Dr. Sanjeet Rangarajan:

Certainly. So in these patient, again most of them or really all of them are presenting in an immunocompetent fashion. So they're presenting very similarly to your chronic rhinosinusitis patients. So certainly CRS is higher on your differential. Allergic rhinitis with an allergy to fungus can also occur. We already mentioned neoplasms which can be either benign or malignant. It's not uncommon to actually have these patients present to you with a CT report or an MRI report that may actually mention something like question malignant or benign erosive tumor. Most of the time radiologists are catching this appropriately, but there's other things you can think about. So tumors. Obviously invasive fungal sinusitis is something you think about. However, the physical exam does differ quite a bit between invasive fungal sinusitis and allergic fungal sinusitis. We talked about mycetomas, but that pretty much leads to the extent of the differential. I'll say that this is very easy to spot, especially if you're used to seeing it.

Dr. Jason Barnes:

And we've talked about presentation, pathophysiology. So you see a patient, you examine them. What's your next step in the workup for these folks?

Dr. Sanjeet Rangarajan:

Great. So like I mentioned, a big part of what I do before I even order any tests or additional scans and things like that is I do counsel the patient. If I'm suspecting a diagnosis of allergic fungal sinusitis, I explain to them that the workup is going to involve several tests and they may require additional interventions as well. So before I even order anything, I'm definitely counseling them on what to expect and I share with them a lot of the information that we've actually talked about today. So with that said, most of the time these patients are presenting with preexisting imaging. They're usually coming with a CT scan or an MRI, and if they haven't, then I'll typically order one. Now if a patient comes in with no imaging, most of the time I'm just ordering a CT of the sinuses. However, ordering an MRI is also very valid and may be helpful in some situations, especially in more advanced cases where we may be concerned about erosion or pressure on adjacent structures and also to assist with surgical planning.

So imaging is a really big part of this. Now, we talked about our differential diagnosis earlier. If I'm not sure or if I'm thinking could this be a tumor, could this be something else, you could potentially, as long as it's safe, take a biopsy or something like that. Certainly an allergy evaluation is going to be important for these patients. So I think testing them for elevated IGE, getting a CBC with differential to try to identify if they have elevated levels of eosinophils. Many of these patients are going to require allergy testing for [inaudible 00:17:59] allergens anyways and they can certainly be tested for an allergy to fungus using typical skin prick or intradermal testing. That pretty much comprises the workup for these patients.

Dr. Jason Barnes:

Could you speak a little bit more to what you will find on imaging, both CT and if you choose to obtain it, the MRI?

Dr. Sanjeet Rangarajan:

Sure. So the basic sinus CT is going to look similar to your chronic rhinosinusitis average CRS patient, but there's going to be a couple of key differences that's going to help us tell the difference between these patients. So certainly nasal polyposis is going to be a big part of this. So you'll see a lot of hyper density. Again, it can be unilateral, but it can also be bilateral. It can present in any or all of the sinuses and interestingly especially in areas that are larger like the maxillary sinus or even the ethmoids, you'll see these hyper dense areas and they can be seen much better as long as you're ... They can be seen if you alter your windowing so that you're not just looking at bone windows on your CT scan. If you change them so that you can actually identify some of these hyper dense areas, this diagnosis can sometimes just give itself away on CT. Those areas of hyper density are generally where the allergic mucin is collecting.

Certainly an MRI, again we mentioned, can be helpful, especially in those more advanced cases. Those are going to be the hyper dense areas on CT are going to show up as hypointense on T2. Bony expansion is also a big part of this. Again going back to our CT, you may see displacement of the lamina papyracea, of the septum, of the skull base. Sometimes the intersinus septum within the sphenoid sinus may be displaced to one side or the other. It looks like a chronic process and again, you have to be careful to identify these changes in anatomy before taking the next step and going to the operating room.

Dr. Jason Barnes:

Before we go to the diagnostic criteria for this diagnosis, is it reasonable to think you can obtain pathology in the clinic or is that more obtained in the operating room? What do we see on pathology?

Dr. Sanjeet Rangarajan:

Yeah, it's a great question. So I think the important thing for anyone to consider if you're seeing patients that present in this way in the clinic, certainly it's reasonable to obtain a biopsy, but you have to really ask yourself is that the safest thing to do always. So certainly we mentioned that there's a wide variety of other pathology that can present in this way. These patients sometimes are going to give themselves away. Certainly you could obtain a biopsy if you have a question, but I don't generally biopsy these patients in the clinic solely because most of their other physical exam or endoscopy findings are pathognomonic for the disease. Like I'm hinting, sometimes it's not always the best or safest thing to take a biopsy in the operating room. Certainly a pathologic diagnosis of allergic fungal sinusitis doesn't necessarily change my managements in the operating room either. Of course we'll discuss surgery shortly.

Dr. Jason Barnes:

And since we've been talking around it, what's the official diagnostic criteria to diagnose allergic fungal?

Dr. Sanjeet Rangarajan:

Yeah, so the symptoms have to be lasting longer than 12 weeks. So it's a lot like chronic sinusitis, but then we have to apply our Bent and Kuhn criteria in order to fully establish the diagnosis. So the criteria are that the patient has to have CRS with nasal polyposis of course, presence of eosinophilic mucin, and then there has to be diagnostic evidence of IGE mediated allergy to the fungus and that can again be performed in vitro or via skin testing. characteristic radiographic findings, so we've already discussed those CT findings with bony expansion, chronic panopacification of the sinuses along with those hyper dense areas signifying the presence of allergic mucin. Then lastly as we said before, there can't be fungal invasion because once there is angio invasion, then we are looking at a different diagnosis of invasive fungal sinusitis.

Dr. Jason Barnes:

And you mentioned eosinophilic mucin being part of the diagnostic criteria. Are there any buzzwords we should know about this, particularly related to the pathology of eosinophilic mucin?

Dr. Sanjeet Rangarajan:

Yeah, definitely. So Charcot-Leyden crystals is the buzzword that you want to think about, and the eosinophilic mucin is generally going to, under the microscope, show fungal hyphae.

Dr. Jason Barnes:

And once you've made the diagnosis using the diagnostic criteria or just in your case, overall clinical suspicion, what's the next step in treatment? Is there a role for medical management or do you go straight to surgery?

Dr. Sanjeet Rangarajan:

So generally, the allergic mucin tends to be so thick. It gets compared to peanut butter or any other kind of goopy substance and it tends to be very difficult for patients to clear this on their own with your typical treatments like irrigations. Certainly medical management can be attempted. These patients do usually feel better with administration of oral steroids, but as we know with chronic rhinosinusitis, this is just a stopgap. It's certainly not a longterm treatment and it is very difficult to get these people 100%

better just on medical therapy, but with that said, I do usually start medical therapy for these patients and it usually is comprised of some type of steroid irrigation. Again, we get them plugged in with our allergy and immunology colleagues in order to obtain the appropriate diagnostics. We can consider certain medications for them. Again, this is not antimicrobial medications, but more on the allergy side and certainly biologics are kind of a new and exciting treatment paradigm for us. There may be some potential there.

I'll tell you that most of the patients that present with this disease into my practice do require some type of operative intervention, and part of that is just getting back to our long-held belief that surgery serves a couple of different roles. One of those is to create a more open sinonasal cavity so that whatever we are irrigating with, whatever steroids we're delivering topically can actually get to where they need to go. That's a very tall order when the sinuses are filled with very thick allergic mucin.

Dr. Jason Barnes:

So can you tell us a little bit about how you counsel patients on surgery, what they should expect immediately postoperatively and following?

Dr. Sanjeet Rangarajan:

Sure. So I talk to these patients similarly to how I talk to all of my functional endoscopic sinus surgery patients. The most important thing I can tell them though is anything relating to managing expectations. So I tell them that, "Listen, here are the details of your disease. I really think that the best option for you would be to present to the operating room for sinus surgery. Our plan is to remove as much of this or all of the allergic mucin as well as open the sinuses and promote a healthier, safer sinus cavity so that we can treat you with topical therapies and other therapies to keep you well."

Now, when I talk about managing expectations, I let them know that surgery is not necessarily going to be a one-and-done type of operation. I tell them, "This disease is occurring because of a systemic reaction to that you're having to circulating fungus in the air." I tell them, "We can't really remove the fungus from the air and it can be difficult to control the systemic reaction." So I tell them that we have to do the surgery, but also compliance with postoperative medications, following up with allergy immunology, whatever avoidance actions we can take. I mean these are all important things and I tell them, "We're going to do surgery. This is what it's going to feel like, but you have to follow up afterwards." So I usually tell them, "You're going to feel better immediately after surgery because we're going to be removing all the polyposis and the allergic mucin and so you're going to have a lot more room than you're used to. So you're going to feel better immediately," but I tell them, "That doesn't mean that you're cured, okay? This is kind of the first step in a long road of getting relief."

Dr. Jason Barnes:

And what's medical management like postoperatively?

Dr. Sanjeet Rangarajan:

So for these patients, I try to get them started on steroid irrigations. I do tend to use [budesonide 00:27:40] and mometasone in my irrigations. Sometimes I'll start them before we go to the operating room, not because I think it's going to significantly improve their symptoms, but it is good to get into the habit of it because like any habits that we try to get into ourselves, it takes time to make it second nature. But afterwards, after the operating room, I do make sure that they're on topical steroids. Usually, I start them on oral steroids five days before going to the operating room and that's just to improve the operative field, and I will taper them down over the course of 10 days following going to



the operating room. Certainly a lot of these patients are on other anti-allergy drugs, antihistamines. It all depends on what their preoperative workup looked like. Immunotherapy is a great option for these patients. Again, we try to get everyone tested beforehand. The worst thing that could happen is we do a surgery and then the rest of their workup is delayed and then they inevitably recur because we're not thinking about the disease as systemic.

Dr. Jason Barnes:

And can you speak of some other possible therapies? You mentioned biologics earlier.

Dr. Sanjeet Rangarajan:

Yeah. We mentioned before that this is an IGE-mediated disease. So the thought is that if you interfere in that type two inflammatory pathway much like we think about polyposis, that certain biologics could be helpful. Omalizumab is an IGE-targeted monoclonal antibody that could potentially help. Obviously, there's other parts of the pathway that could be deranged. So targets for IL5, IL4, IL13 may also serve some good. I'll say that these are new medications and so again because these are younger patients and they may be dealing with this disease for some time, there's a complex decision-making process that comes with access to the drug, cost of the drug, and whether or not they are going to be more helpful than some of the other modalities that we're utilizing.

I'll mention antifungal agents because historically, there's a wide variation in how we approach this disease. Obviously, it's called allergic fungal sinusitis so you'd think that maybe if we treat it like a fungal infection, we would get some relief for these patients. Certainly in my community, there are many people that will still utilize antifungals, either topically or orally. Most of the evidence is not there for this. So topical antifungal, oral antifungals for allergic fungal sinusitis is not part of my typical treatment regimen.

Dr. Jason Barnes:

So we've gone over treatment here. We've talked about surgery and postop medical management, including steroids, immunotherapy, possible biologic therapy. How do you counsel patients on what they should expect in terms of are they likely to recur, are they going to need to take these medications for life? How does that conversation go?

Dr. Sanjeet Rangarajan:

Yeah, so I tell them that if they don't follow up again, you remember I tell them that, "You're going to feel great after surgery," especially with many of these patients who present on the later side. They've dealt with some pretty significant symptoms for some time. So automatically ... If I'm talking to someone who is getting surgery for something that's not polyps or not allergic fungal sinusitis, I usually actually tell those folks that they're going to feel a little bit worse after surgery and then have a slow recovery. These patients, you really have to tell them that, "If you don't follow up because you feel great, this will almost certainly return." So I tell them, "Not only do you have to follow up, but you have to be compliant with your topical steroids."

For patients who are concerned, "Do I have to do this for the rest of my life? Is this a lifelong disease like type one diabetes or something like that," I tell them that the disease can get better with time, but some of my patients who are presenting in their 20s, it may be some time and we may need to really stay on top of things for a while and make sure that they get all the [inaudible 00:32:18] therapies and diagnostics to keep them out of trouble. I do tend to see these patients in the office fairly routinely. If you do a good surgery, nice wide open cavities, we mention that topicals are going to get there more



easily, but there's also an important surveillance role for a nice wide open ethmoid cavity, sphenoid cavity. If you can see these areas in the office, you can sometimes detect the return of polyposis and allergic mucin and intervene as necessary.

Dr. Jason Barnes:

Do you ever have patients who wonder if they were to move to a different geographic region if that would solve the problem?

Dr. Sanjeet Rangarajan:

Yeah, absolutely. Obviously again in Tennessee, especially in the southwestern part of the state, it's very humid. There's a very high incidence of allergic fungal disease. So there are patients who either hear from their friends or hear from some other area that maybe if I move to Phoenix, Arizona or some other really dry place, will I get better? In some cases, the answer is yes. I mean I have seen that happen with patients, but then others are somewhat disappointed when they move as well. Obviously, the disease is endemic in certain geographic regions for a reason.

Dr. Jason Barnes:

And you kind of started talking about this. What's your followup regimen with them, both immediately postoperatively and longterm?

Dr. Sanjeet Rangarajan:

Great question. So again, I'm really hypervigilant with fungus patients. So I'll usually see them back at about the one to two week mark immediately postoperatively. This is the time when they're usually still tapering off of their oral steroids. I see them for a couple different reasons. A) most of them need some type of sinonasal debridement or at the very least an diagnostic endoscopy to clear out any retained blood product or retained packing material. I'll usually see them about two weeks after that at about the month mark. Many may consider that to be a little bit overkill, but for me, it's another opportunity to really drive home the concept of following up when expected as well as staying compliant with irrigations and you really get a sense early on as to who's compliant and who's not based on sometimes the appearance of that sinonasal cavity. So I don't do it necessarily to test the patients, but more to gather information as to who is going to need more help to stay on top of the disease.

So after about that month mark if they're going well, if they're doing their irrigations, I'll see them maybe a month afterwards or maybe six weeks. Then I usually for the first year see these patients every two to three months as long as they're not having issues. I tell my patients to have a very low threshold to call me because, again, these patients can recur even in the first year with polyposis. I tell them to be mindful for some of the "invisible" symptoms of the disease, things like anosmia which recurs and things like that. So I try to stay in close contact with them over the course of at least the first year.

Dr. Jason Barnes:

Is there a thought that this disease ... It presents in younger folks. Is there a thought that this disease kind of burns out over time?

Dr. Sanjeet Rangarajan:

Yeah, there's some thought with that and anecdotally, I can say that I've seen that in my patients as well. However, again, I don't know if it's because of the specific area that I'm in, but I mean I have seen people who are later in their 40s and 50s still get the disease, but rarely do I see someone in late adulthood who has florid allergic fungal sinusitis. Occasionally, a fungal mycetoma isolated sinus, that sort of thing, I've seen that more commonly in older patients, but I think it's fair to say that the disease does tend to "burn itself out" or improve over the course of years, especially if patients are presenting to you in their 20s and 30s.

Dr. Jason Barnes:

One other question that I did want to ask you about surgical management is if it presents unilaterally, do you automatically perform bilateral sinus surgery?

Dr. Sanjeet Rangarajan:

So it's a good question. I think you're going to get answers that are across the board. We've obviously talked about this disease as a systemic disease, not something that's focally limited. So with that thinking, the thought would be well if it's systemic disease, then you should do surgery on both sides. I do tend to be a little bit more on the conservative side and I would only probably treat someone on one side if there were absolutely zero evidence of disease on the contralateral side. I verify that several times. So obviously, I'm looking in the office and then we usually would get imaging afterwards. If it was unilateral at that time, I would probably still consent for bilateral surgery at the time of the operation, but if I look in at the time of surgery as well and it appears stone cold normal, I probably would actually leave that side alone.

Some may say, "Well why? It's a systemic disease. You're there. You could subject this person to more than one anesthesia." Again, I tend to be more conservative and my thought is that if we can alleviate the anatomic obstruction, remove the allergic mucin from one side, keep them on bilateral topical irrigations and whatever treatments, systemic treatments we were going to try before, to me, it's better to keep a native functioning sinus upfront, especially again if these patients end up going back to the operating room in the future. Many of these patients have to go more than once. You'll always have another chance. So that's my kind of personal thinking about it.

Dr. Jason Barnes:

Well Dr. Rangarajan, this has been an awesome discussion. Before I move into our summary, is there anything we haven't talked about or anything you wanted to highlight?

Dr. Sanjeet Rangarajan:

I think the other important thing that I didn't mention before is with regards to surgical technique, I really think ... I mentioned that this is difficult to get all of the allergic mucin out. It tends to be very thick, peanut butter consistency. I really believe that opening the sinuses is one main objective, but it's really important to go after every last bit of allergic mucin. I've found if I shortchange myself, leaving some in the frontal sinus, some of these areas that take some more time, effort, and risk to get to, I do find that these patients recur quickly in those areas. So I do think it's really important to stay on top of these patients by doing a good complete job in surgery.

Dr. Jason Barnes:

Well Dr. Rangarajan, thanks so much. I'll now move into the summary. Allergic fungal rhinosinusitis is a form of rhinosinusitis that is most commonly seen in the South, Southeast along the Mississippi River

Basin, and the pathophysiology includes a TH2 response or allergy to fungus in the nose. Workup includes objective findings such as in-office endoscopy, CT scan, and occasionally MRI if there's a need to tease it out from another possible pathology. Lab workup and allergy testing will reveal an IGE response to fungus, and the official diagnosis is made by the Bent and Kuhn criteria which are the following: presence of CRS with nasal polyposis, the presence of eosinophilic mucin, evidence of IGE-mediated allergy to fungus, and characteristic radiographic findings and of course no fungal invasion. Treatment includes medical management similar to chronic rhinosinusitis, including rinses and steroids, but these patients often need to go to the operating room for endoscopic sinus surgery, both to open up sinuses and take down septations, but also to remove all of that mucin. Disease course is often more aggressive in younger adults, but might be easier to control in later decades.

Anything else you would add, Dr. Rangarajan?

Dr. Sanjeet Rangarajan:

No, I think that about sums it up in a nutshell.

Dr. Jason Barnes:

Awesome. Thank you so much.

I'll now move onto the question-asking portion of our time. As a reminder, I'll ask a question, pause for a few seconds, and then give the answer. For our first question, describe the classic imaging findings of allergic fungal rhinosinusitis.

So as we talked, this disease is often described as being unilateral, but clinically it seems that it can be bilateral quite frequently and the CT scan will demonstrate opacified sinuses with dense accumulations of eosinophilic mucin and possible bony erosion. If an MRI is obtained, on the T2 imaging, those hyper dense lesions on the CT scan will be hypointense.

For our next question, name the five aspects of the Bent and Kuhn criteria for diagnosis in allergic fungal rhinosinusitis.

The five aspects of the Bent and Kuhn criteria are one, the presence of CRS with nasal polyposis; two, eosinophilic mucin and recall that those contain Charcot-Leyden crystals; three, evidence of IGE-mediated allergy to fungus; four, characteristic radiographic findings that we've discussed; and five, no fungal invasion.

Finally for our last question, what is the role of antifungals in this disease process?

As we've discussed, historically it was thought that antifungals played more of a role in this disease process, but because this is more of an allergy than an infection, there's almost no role for antifungal medication in this disease process. But there are promising medical therapies such as biologics which are on the horizon.

Thanks so much for listening and we'll see you next time.