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. Nick Rowan, and we will be discussing juvenile nasopharyngeal angiofibroma. Dr. Rowan, thanks so much for being here.

Dr. Nicholas Rowan:

Hey, Jason. Thanks so much for having me. Excited to talk with you today.

Dr. Jason Barnes:

When we talk about JNA, what is the classic or who is the classic patient who presents to your clinic who has JNA?

Dr. Nicholas Rowan:

Juvenile nasal angiofibromas, to start off with, the nomenclature or the way that they're described does change quite a bit. Sometimes you'll hear it called a juvenile nasal angiofibroma or a nasopharyngeal angiofibroma or just a fibroma, and it's all the same thing. The real classic patient that presents to you is a young male who's got unilateral, at least it started as unilateral, nasal airway obstruction or nasal blockage. Really the classic sign that they have is they have epistaxis or nose bleeding. Usually, it's recurrent and it's from one side. Some of them might actually be pretty severe and they might require medical attention. That's really what prompts them to have them to present to you originally.

Despite the bleeds and the nasal blockage, there are other symptoms that present. So sometimes they've have a little bit of pain, discomfort. It's not uncommon if there's a tumor in their nose for them to have drainage, sometimes pretty thick kind of [inspissated 00:01:35] secretions coming out the front of their nose. They might also say that they have some diminished sense of smell on that side. In kind of more advanced presentations, they'll have some localized facial pressure on the side of the tumor. Sometimes if it's a really, really big tumor, they might even say that their cheek is swelling or they're having ... They notice that the roof of their mouth is feeling a little bit funny and it's changed a little bit.

In general, things you need to keep in mind that it is generally a young male. Just before puberty or during puberty are the most common times for it to occur. It's really rarely seen in older individuals. That's kind of the standard HPI that we hear from a patient with a JNA.

Dr. Jason Barnes:

Sure. So Dr. Rowan, are there any risk factors that you're asking about in these patients when you're evaluating them?

Dr. Nicholas Rowan:

So the biggest risk factor is generally just being of the male sex. There's no really predisposing factors that we know of that causes these tumors to arise.

Dr. Jason Barnes:

And when you're seeing these folks in clinic, physical exam is going to be part of what you do after your HPI. Before we get into nasal endoscopy, what are some things you might be looking for apart from nasal endoscopy?

Dr. Nicholas Rowan:

So one of the real telltale signs that they have a juvenile nasal angiofibroma is that they have a lot of packing in their nose because they've had a really bad bleed and they're present to you in kind of dramatic circumstance. If however the tumor has been kind of slowly growing over time, you might see some drainage from the front of their nose, some thick secretions. Again, you want to make sure to look in their mouth and the back of their throat. Every single patient you see, I think it's really important to do a comprehensive ear, nose, and throat exam, especially if you're an otolaryngologist. The burden is on you to do that. So you want to make sure that their palate is not effaced or kind of pushed out of the way. Sometimes the tumor will even come into the nasopharynx and down into the oropharynx and you can see it just with a flashlight going in the front of the nose.

You also want to make sure and evaluate for proptosis, their eye kind of bulging out a little bit, being a little bit displaced. They may have some facial asymmetry or swelling of the side of their cheek that the lesion is on. Another less common finding you might see, but if you have a big obstructing mass of the nasal cavity, they might have some epiphora or drainage from their eye.

Dr. Jason Barnes:

Moving onto nasal endoscopy, I feel like this every resident's fear, that you get a mass in the nose and you biopsy it and then it never stops bleeding. So what are you looking for on nasal endoscopy when you evaluate these patients and what tips you off to not biopsy this?

Dr. Nicholas Rowan:

So certainly that is a very reasonable fear to have and I would encourage you as a resident yourself and even if you're an attending to keep that fear with you because sometimes you should really consider doing a biopsy in the operating room, and I think this is one of those situations. So if you see a very large tumor that has lots of big blood vessels on it, it's hypervascular in nature, or really just kind of looks angry, something that's pulsatile, those are all things that I would avoid biopsying in the clinic. Juvenile nasal angiofibromas, they do have a submucosal extent to them, and sometimes it's difficult to actually see where the tumor might be. If you're going to have to go kind of searching for it to really make a tissue diagnosis, whatever the mass is, I'd say in that situation and in my personal practice, I defer and take them to the operating room instead of doing it in a clinic for the very appropriate concerns that you highlighted.

Dr. Jason Barnes:

Now that we've talked about kind of your first exam in clinic, I wanted to move onto pathophysiology. What is the etiology? What causes this tumor?

Dr. Nicholas Rowan:

So I think that we have an idea of what causes this tumor, but we really ... There's not a great kind of scientific answer to this. So we know that it happens in young males and it happens during puberty. So just kind of based on our gut, we do think that there is some sort of hormonal related reasoning for this tumor to happen. There are some case reports where patients are on hormonal therapy like testosterone even after having a tumor taken out a long time ago and they can have regrowth of their disease, but this is definitely not something that is firm and set in stone. There's a really nice article that came out just last month, March of 2020, that looked at prostate-specific membrane antigen expression, and they found that it was found in 100% of all patients who had a primary JNA. So the suspicion is there that it's somehow related to testosterone and hormones, but we don't know exactly.

There's also another theory that it could be emanating from a non-obliterated first branchial artery, but this is kind of theoretical in nature.

Dr. Jason Barnes:

And what is the classic histopathology of these tumors?

Dr. Nicholas Rowan:

So characteristically, the histopathology, it's usually, again, pretty classic as are many things with JNA. So it's a pseudo capsulated lesion that has irregular vasculature and it's just full of blood vessels of different sizes and it's in a thick, kind of fibrous stroma which your pathology report may also notice that there's collagen and fibroblasts in it, but a fibrous stroma with lots of large and irregular size blood vessels is kind of the key to histopathologic diagnosis.

Dr. Jason Barnes:

One of the other things that I've noticed is an important aspect of considering this tumor is its site of origin. Where does this tumor classically present in terms of location and what are the blood vessels feeding it?

Dr. Nicholas Rowan:

Yeah, so it is ... Again, there are many things about a JNA that's very classic from both the presentation and actually the tumor itself. The most common place that it originates is from the sphenopalatine foramen. So that kind of helps you think about kind of where it's going to grow or obstruct. So right next to that sphenopalatine foramen is the nasal cavity and the nasopharynx and the pterygopalatine fossa which is kind of how it gets its name. So almost always this tumor is supplied by big blood vessels, namely the carotid system. Most commonly almost in 100% of the cases, it comes from the external carotid system. So the terminal branch of the external carotid is the internal maxillary artery which then gives another branch, the sphenopalatine artery. That's the most common that you'll see bleeding ... Excuse me. You'll see blood supply from, but certainly also the pharyngeal and facial vessels depending how big the size is.

It's really worth noting and something that I'll highlight kind of as I anticipate our discussion goes along that in advanced disease, it's no uncommon for blood supply to be directly from the internal carotid artery. In up to 30% of cases, especially in really big tumors, the blood supply can be bilateral in nature and which really highlights something which I am guessing we'll get into in a moment here, but angiography, knowing where the blood supply is from. I think that's really important so really great question.

Dr. Jason Barnes:

Another one of the questions that I like to ask is about the natural history of this disease. When you counsel patients on treatment, what do you tell them will happen if they elect to do nothing about this?

Dr. Nicholas Rowan:

Yeah, great question. I think a JNA is very similar to other tumors. Unfortunately, it will continue to grow. Over what period of time, it's really hard for us to say. Because it is a rare pathology, I don't think that we have great numbers on that. With some of our cancers, we can say that definitely over a certain period of time it will grow and invade certain things. JNA, at some points it's faster than others, we

suspect, and I think it's worth talking about the different kind of directions I was alluding to before, where it will go, and those are the different things that I counsel my patients on.

So from the sphenopalatine foramen or the pterygopalatine fossa, the most common place for this to go is into the nasal cavity and the nasopharynx, eventually crossing over the nasopharynx to the other side, sometimes even pushing the nose, excuse me, the nasal septum over to the contralateral side which will have the patient present with bilateral nasal airway obstruction. So that's usually at presentation. If a patient decided to wait on this though or we did nothing, which in many cases I would not counsel, the tumor can extend laterally. It can go into the pterygopalatine fossa out towards the infratemporal fossa and it can cause anterior displacement of the posterior maxillary wall. So the back wall is bulging into the sinus and it can come into contact with the muscles of mastication out laterally in the cheek and even the soft tissues of the cheek. So when I was talking about physical examination and presentation, that's why the cheek swells, because it kind of comes around that maxillary sinus towards the front of the face.

The tumor can also go posteriorly. So what's posterior to the pterygopalatine fossa? Well this is the stuff that you ... These are some really kind of critical neurovascular structures, including the internal carotid artery, some of the nerves that come out of the skull base like cranial nerve number five. It can extend into the cavernous sinus and really kind of treacherous territory, but it can also go superiorly as well. Remember that your eye is immediately above where the tumor is originating from. So in through the inferior orbital fissure which can displace the eye either laterally or anteriorly, resulting in proptosis. Remember that these tumors, much like other pathologies in the sinonasal cavity, they can kind of push on bone and cause that bone to resorb. It doesn't necessarily eat through bone necessarily, but a lot of times it's by direct pressure. But certainly the [cancelous 00:12:38] root of the pterygoid process or the pterygoid wedge as I refer to it may be part of the site of origination or even the site of recurrence of disease.

Dr. Jason Barnes:

Before we get into workup, you say that this is a pretty classic presentation in tumor, but what else do you keep on your differential diagnosis?

Dr. Nicholas Rowan:

Yeah. So again, probably the first five things I think about when I have a young man who kind of fits all the criteria with nasal blockage, a tumor in his nose, and some bleeding, JNA, JNA, JNA. Those are the things that I worry about. I would also submit to you that patients can present with antrochoanal polyps, common things being common. That may be something on the differential diagnosis. Certainly it's a much less benign pathology than is a JNA, but radiographically it may also present with a unilateral lesion that's filling up the maxillary sinus and effacing the wall coming into that nasal cavity and nasopharynx, especially in the right demographic.

Other differential diagnoses you might want to think about, so other things that bleed. Pyogenic granulomas and hemangiopericytomas are also, they may also present as tumors in the nose that bleed. Certainly paragangliomas, more common things being common, they could have really bad chronic rhinosinusitis with massive nasal polyposis or allergic fungal rhinosinusitis with both kind of present with very large polyps. Even further down the differential are just run of the mill kind of nosebleeds or epistaxis. Certainly posterior nature would be more common because these, again, are kind of dramatic. They may also have just kind of run of the mill rhinitis or runny rose or allergic rhinitis. Again, this would be less likely. Really the list goes on and on with diminishing returns of any kind of tumor that might happen in the nose, but I think those are kind of the big ones.

Dr. Jason Barnes:

So moving onto workup, you have a patient who you highly suspect has JNA. What is your first step in workup?

Dr. Nicholas Rowan:

So imaging is certainly the next step. Number, again if it's a dramatic presentation and they're bleeding, always the first response is make sure that the patient is okay and that they're stable, they're not bleeding, and they've not having any issues with that. Once you are assured that there's no impending doom or any potential problems with the patient, imaging is the next way to go. So in this situation, I would pursue both a CT scan as well as an MRI. I would prefer to get both with contrast because again, a highlight of this tumor is the vascular nature. So I want to know where the blood supply is coming from and if we are thinking about maybe taking this out down the road, how are we going to do that and where are we going to run into potential risk spots.

So the CT scan, as all CT scans are either really great at identifying bony landmarks, it'll kind of tell you where it is. There's a super classic sign called the Holman-Miller sign. Again, I was talking about the posterior wall of the maxillary sinus being pushed out by a tumor growing in that sphenopalatine foramen. That's one of the best things to look for. It's pretty easy to see on an axial cut CT scan. So the CT is what I would probably look at first, and then I'd look at an MRI. I'd look at it in all three different cuts, coronal, sagittal, and axial cuts, to really kind of get a good extent of where the tumor is. I'd look at the T1, the T2, and the T1 post con which is probably the most helpful. The T1 is going to give you kind of an intermedia signal, not necessarily give you a ton of information other than what a standard T1 sequence might show you. The T2 is going to show you a bit more. It's going to start to show you the heterogeneous signal. There are significant flow voids in it because of the prominent vasculature of the tumor, but the T1 post con with contrast rather, with gadolinium, really will show prominent enhancement of the tumor and kind of show you exactly where it's at to really give you a great idea of where that soft tissue is.

Dr. Jason Barnes:

And what about angiography? What's the role for preop angiography and how you use it in planning?

Dr. Nicholas Rowan:

Yeah, so I think that angiography is no short of critical and I would suggest that in the current era that we're in where technology and kind of complete and thorough medical care is available, I would argue, like some authors do, that this is an essential part of workup and comprehensive management. It's generally my practice to do so. I guess there are certain situations where if the tumor was very small, if the pathology was unknown, then you could get by without doing an angiography. However, given again the classic appearance of these tumors, I think it's something that comes. You kind of confirm with your CT and your MRI. Once you know that you're kind of dealing with a JNA, you want to make sure that you know where the blood supply is from.

Dr. Jason Barnes:

Sure thing. This might kind of be an odd question, but how do you make the official diagnosis of this? Is there a way to know before you obtain a pathologic specimen that this is JNA?

Dr. Nicholas Rowan:

Yeah, so it goes back to history and presentation is key for this. You've all but made a diagnosis. Tissue diagnosis is really the gold standard and so that's how you do it. Typically what I'll do in my practice and it varies from time to time and from practice to practice, but we'll have a pretty darn good idea that's what we're dealing with. Because it is a classic pathology, we can do a biopsy with a frozen section in the operating room to confirm that we do have a diagnosis. Again, kind of for your concerns you brought up before, the potential bleeding in the office, it's my preference not to do these in the clinic because they do bleed. It's also my preference not to put young males to sleep over and over again if I can avoid it. So I try to save an anesthetic and put them to sleep once and hopefully, we can get an official diagnosis while preparing for complete excision at the same point.

Dr. Jason Barnes:

As I've been kind of reading about this pathology, I've noticed that there are a lot of classification systems. I'm curious to know what classification system you use when approaching these tumors and how you use the classification system in preoperative considerations.

Dr. Nicholas Rowan:

Yeah, absolutely. I think that this is a really important question and I would argue that as you're kind of implying, I'll just go out and say it, it's overwhelming. There are over ... There's something in the order of like 12 major staging systems, meaning that really kind of well-respected authors, really well-done articles and leaders in our field, there's a lot of noise out there when we talk about staging systems. I think it's worth putting out and saying that a universal staging system is something that's needed so we're all kind of speaking the same language. I think universal staging system should really help with planning as you're mentioning. So if I'm, as a surgeon, going to be taking out one of these tumors, I want to know kind of what I'm getting myself into ahead of time. I also similarly want to be able to tell patients about some of the associated risks, the anticipated outcomes, and what I think their prognosis is overall.

I think that, finally, universal staging system allows us to develop better standards of care by being able to discuss our outcomes. I think it's really important for JNAs. Again, we keep on hitting on this over and over again, but they're bloody tumors. So you want to know in advance if there's any way to figure out how much blood you're going to lose and potentially a need for a transfusion which is not a benign intervention at all. You want to know how to plan your operation and how much you're going to need to stage, whether or not you're going to need to stage the operation, the likelihood of having leftover disease, or the need to go back to the operating room at some point in time. The staging system in my practice that most closely reflects all these goals is the University of Pittsburgh, University of Pittsburgh Medical Center staging system by Carl [Snyderman 00:21:42] and colleagues that was originally published back in 2010. It's really unique in that it accounts for the vascularity of the tumor by incorporating some of those finer details from the preoperative angiography and subsequent embolization, presumed embolization.

Unfortunately while podcast mechanism is really great, it does have some shortcomings and I can't physically show you right now, but the way that I think about the UPMC staging system, I think about it as a traffic light basically. So there's five different rating systems, excuse me, stages: one, two, three, four, and five. Five is broken down into medial and lateral or M and L kind of talking about where the carotid artery goes, but stages one, two, and three, they're kind of in the green light area. They are isolated just to the nose for stage one, the nose and the associated sinuses for stage two. For stage three, they start to get into some of the danger areas and they start to erode the skull base, the orbit,

but they don't have any additional blood supply to them after embolization. So once you have embolization, the surgery becomes a whole heck of a lot easier.

Stage four, that's kind of your amber light that's, "I better pump the brakes a little bit or maybe I should stop and make sure that I'm, number one, surgically trained and skilled enough to do this, number two, that I have the right kind of tools that I need in place," because stage four has residual vascularity, so leftover blood supply. So even if you had a great embolization preoperatively, you're still going to have some associated bleeding. Stage five is your red light. You should really stop and kind of think and make sure that you are being thoughtful about your operation. You should consider staging the procedure because there's a residual blood supply from the internal carotid system generally and there is intercranial extension of the disease as well, making it for a much riskier surgery when there is a higher probability and chance of untoward outcomes.

So I don't think the UPMC staging system is necessarily perfect, but I think it is a really great common language for us all to talk about because it does incorporate a lot of these really important facets to it, so anatomy, where the tumor is, the likelihood of your outcomes, and it does kind of help in your surgical planning as well which I think is really, really important.

Dr. Jason Barnes:

Moving onto treatment, surgical excision is going to be the mainstay of treatment, but there is maybe some roles for medical therapy and radiation therapy. Before we jump into surgery, can you speak to those?

Dr. Nicholas Rowan:

Yeah, absolutely. I would argue that it depends who you talk to a bit about medical and radiation therapy. So going back to the hormonal kind of stuff that we were talking about before, the thought that this is hormone related, there is some evidence that testosterone receptor blockers like flutamide do work. They're used rarely. I suspect that with more papers like that I referred to before about the prostate-specific antigen, we will see kind of more testosterone-related therapy as a potential additional modality, but again, medical therapy is not commonly used. Radiation therapy is typically reserved for an adjuvant therapy. So when or if surgery doesn't work or there's disease that is not accessible surgically, in some centers, they use this as an option. However, some authors are concerned about this given the unknown kind of longterm consequences of stereotactic radiotherapy, especially in young children.

Dr. Jason Barnes:

So moving onto surgical excision, can you tell us about your preoperative approach and then how you choose your surgical modality?

Dr. Nicholas Rowan:

Yes, absolutely. We've talked about how I would approach it preoperatively and that is with comprehensive imaging which includes a CT, an MRI, and an angio. The timing of the angiography is really important to me though. I got a lot of the information especially from that MRI, but I plan to embolize them after their angiography. That's done really within 24 to 48 hours, and I've asked many of my endovascular colleagues about the most appropriate timing for this and I'll tell you that I don't think anybody has a really great answer for me. However, the most important point here is that preoperative embolization is really important to minimize the associated risks of bleeding. It can significantly decrease

actually the size of the tumor, but again, you really want to do your best to knock out the robust blood supply from the external carotid system that's feeding these tumors.

And so you asked about surgical modality. So I think as we progress with our advances in endoscopic skull base surgery and we have lots of rhinologists who are comfortable and neurosurgeons as well ... And we'll talk about that as well. This is not just an otolaryngology topic. As neurosurgeons and otolaryngologists both becoming increasingly familiar and comfortable with endoscopic approaches, the endoscopic approach is really kind of their preferred treatment option of choice. There's a really nice meta-analysis that came out by some authors from Georgia from Augusta and Emory that showed that the outcomes are generally improved with the endoscopic approach. There's lower risk of residual disease and for those authors, they actually go as far as to say that the endoscopic approach should be considered the standard of care. So while there is certainly and traditionally there always was a role for open resections of these tumors, doing wide openings of the face and/or doing craniotomies in order to extract this, I think that's becoming less and less common and really should only be considered in kind of rare cases or if really critical structures are involved such as the orbit or the carotid is encased or something else that really is an extraordinary kind of presentation.

Dr. Jason Barnes:

How do you approach the control of bleeding during these cases? How do you anticipate bleeding and how do you counsel folks before surgery on their risk of a need of transfusion?

Dr. Nicholas Rowan:

I mean as a surgeon, that is my probably biggest concern preoperatively. So number one, I make sure that I have the tolls available that I'll need to take this tumor out. So Coblator are something I really like to use to kind of get around the tumor. I feel that it does a really good job of controlling bleeding, but bipolar cautery as well I think is important. Having an extra set of hands is really, really important. I'm alluding to it stronger and stronger here, but I think that doing this as a team-based surgery, especially for the large surgeries, is really important to make sure that you can have somebody to suction some bleeding away. If you're working in a really small hole and there's bleeding, then it makes it that much more difficult.

I do stage all these ahead of time. So if you read through any of my notes, you would see that I'd say this is whatever 16-year-old boy with a UPMC stage ba-ba-ba and that will help me in both my thought process about the surgery, but also prepare the patients and their family. Again, you're talking to mom and dad a lot, often in these situations as it is a young child. So I don't have a particular number that I say that I'm going to stop at, but increasing the stage of disease, the more likely I am to [inaudible 00:29:56] surgery and stage it. One other thing that's really important to say is that I get access first just like any other surgery. Just because I'm operating in the nose, I still maintain all the basic surgical principles that we all learn in managing head and neck tumors. That's getting access and kind of seeing the tumor before tackling it. So the first move is not about just taking the tumor out. It's making sure that I have appropriate access to it and then after I have access, really kind of isolating the blood supply. So I want to do my best to cut off any residual blood supply as soon as I can. That's my thought process for these anyways.

Dr. Jason Barnes:

You talked about endoscopic approaches being the mainstay of treatment, but how do you know if and when you need to have a more extensive approach like a craniotomy?

Dr. Nicholas Rowan:

So again, I think those are really rare situations. I will ... Another valuable point that I didn't mention was that we discuss these as a team. I generally do these with a neurosurgeon. So we do talk about it as a team beforehand. Sometimes it is a game-time decision to a certain degree to say stop and it's to use your better judgment, but again, the things that really make me think about doing some sort of open approach, number one, it needs to be said that these are combined approaches, not just straight open approaches. Usually we're using endoscope to really get the actual visualization that we're afforded by that, but number two, if there's a ton of intracranial disease that's really hard to get to and I'm worried about control of critical neurovascular structures, we may consider doing an open craniotomy for some of the intracranial spread. If the internal carotid artery is encased, that's also something that we kind of think about and we worry about, but in that case, it may very well be something that we take out the majority of the disease and then we will stage, potentially even re-image down the road to do a kind of further more extensive surgery. Does that help?

Dr. Jason Barnes:

Yeah. Understanding that this is a spectrum of tumor, there are different stages that can portend different outcomes, how do you typically counsel patients on the outcomes and expectations and risk of recurrence?

Dr. Nicholas Rowan:

Yeah. Again keeping in mind that the staging, I think it's really important. So stages one through three should generally be pretty gettable and so hopefully the recurrence rates are pretty low in those situations, but things like UPMC stage four and stage five, so tumors that have leftover blood supply from the carotid system and are certainly going [intracranially 00:32:39], you do worry that there is, number one, residual disease, and number two, if there is residual disease, that this becomes essentially recurrent or starts growing back. Some of the rates are as high as 15% to 20% depending upon, like you said, kind of it's a spectrum of disease. Some of the more advanced tumors, they're more likely to recur.

The recurrence, it's notable to talk about where it happens. So if you left tumor on the internal carotid artery purposefully, again keeping in mind that this is a benign diagnosis, this is not a cancer, this is something that we'll talk about what happens with them over time, but it's not something that's going to change their life tomorrow necessarily. If you need to leave a little bit behind on a critical neurovascular structure like the internal carotid, we do. So if you leave it on the internal carotid artery, that's most likely where it is to recur if you have regrowth of disease, but also certainly the recurrence often occurs at the base of the sphenoid, really at the interface of the sphenoid and the pterygoid plate or the pterygoid wedge as I call it.

So classically, some surgeons describe drilling down that bone to make sure that you don't have any residual disease, but again, the risk factors for recurrence or regrowth, again we will [inaudible 00:34:06] residual disease and so I think a better term is probably regrowth of tumor, are patients who are young because they've got higher probability of of having hormones and going through puberty and causing regrowth of the disease if there is in fact a hormonal component to it. Big tumors that are in bad places, so in the brain, excuse me, in the intracranial space or against the carotid artery or in the orbit.

Dr. Jason Barnes:

Post-surgically, how do you follow you with these patients?

Dr. Nicholas Rowan:

Great question that I would argue we don't know the answer to necessarily. For me, for many of us, postoperative MRIs are really important in conjunction with nasal endoscopy. My preference in many skull-based tumors is to get an immediate kind of postoperative MRI to really figure out what's going on and evaluate the amount of residual disease in order to make sure that in the future, I'm not getting confused about what's scar, what's inflammation, what's something that's alternate anatomy, something that I changed by manipulating the anatomy inside their nose. So looking in their nose with a nasal endoscope and an MRI on the order of about every six months or so over the first two to three years is important for me. That's a little bit nuanced depending on how old the patient is. Again, these patients, they're not likely to have regrowth of their disease if they shortly thereafter become kind of a full-fledged adult and they're not going through puberty or don't have kind of some of the risk factors. They kind of get out of the characteristic age range.

Again, I mentioned this was a topic of debate and actually when I was in your shoes as resident, we asked this exact question. We said, "So if you leave tumor behind, if you have residual disease, number one, what does that patient kind of generally look like? Number two, when does a tumor regrow and how long should you surveil them for?" I think this has really, really strong and important clinical considerations. What we found were that patients who had advanced disease, as we mentioned stage four and stage five, those are the patients who had residual disease. In the small series we did where there were a small number of only 12 patients with residual disease, only a third of them had regrowth and required additional surgery. Typically within the first year, you knew that they were having recurrence of their disease and I know it's hard to have kind of meaningful statistics based on this small in that I'm describing, but with a rare tumor that is 0.5% of all head and neck cancers, it's notable or important to note some of the trends even when it's a small amount of data.

Dr. Jason Barnes:

Well Dr. Rowan, this has been a really comprehensive discussion. I appreciate your time. Before I move on to summarizing what we talked about, is there anything you'd like to add?

Dr. Nicholas Rowan:

Not so much. I think we hit on a lot of the key points. Again, I hinted at it kind of throughout. I think it's really important to work in a multidisciplinary team for this. JNAs are tumors that, despite them being classic and despite having known about them for a really long period of time, they can be humbling and they can unfortunately carry a significant amount of risk. I just wanted to come out right and say it. So for those reasons, I think it's important to work with a multidisciplinary team. I personally do all of these tumors with my neurosurgeon to make sure that, number one, we're always practicing, we're always working together, we're working as a team, and we have that extra set of hands in there. God forbid there was some bleeding or some difficulty with the surgery. I think that's really important to have, to work as a team, especially for a large tumor with a significant amount of risk like this.

Dr. Jason Barnes:

Sure. Well thanks so much for your time. I'll move onto our summary now. JNA is a benign highly vascular tumor that presents in adolescent males most commonly with nasal obstruction and recurrent epistaxis. The etiology isn't entirely understood, but could include a hormonal component especially given the male predominance and more recent studies. Workup includes nasal endoscopy without biopsy in clinic and a CT and MRI to understand the full extent of the tumor. Also preoperatively, you should obtain an angiography which will provide information about the blood supply to the tumor and also provide a way to perform embolization prior to surgical resection. Increasingly, surgical resection is

most commonly performed endoscopically. There is still some role for combined approach for more extensive tumors, especially if they are involving the internal carotid artery. Outcomes, as we talked about, are generally very good for lower stage tumors, but with the higher stage tumors, there can be an increased regrowth rate which is why these patients need to be followed up routinely with imaging.

Dr. Rowan, anything else you'd like to add?

Dr. Nicholas Rowan:

No, sir. That sounds absolutely perfect. Great summary and I'd go so far to say that is all in a nutshell.

Dr. Jason Barnes:

Well thanks so much. I'll now move onto the question-asking portion of our episode. As a reminder, I'll ask a question, wait a few seconds, and then give the answer. So the first question is what are the common presenting symptoms of JNA?

The two most common presenting symptoms of JNA are nasal obstruction and epistaxis. Of course this epistaxis can be recurrent and is almost always unilateral. There are also other symptoms that can include headache, rhinorrhea, [inaudible 00:39:41] drainage, facial pressure, and cheek swelling.

For our next question, what is the most common location and blood supply of JNA?

So JNA most commonly occurs at the sphenopalatine foramen and can therefore involve the nasal cavity and the PPF. In terms of the blood supply, this most commonly comes from the internal maxillary artery, but can also include the internal carotid artery and contralateral blood supply.

Next question, what are preoperative considerations in this patient subset?

As we alluded to several times through this episode, embolization can be very helpful here and can aide in surgical resection. Additionally, you should have a conversation with the patient about the risk of significant blood loss and the possible need for transfusion and also the possibility of neurological deficits and most commonly numbness.

For our final question, what is the risk of recurrence in these patients?

Again as we discussed, earlier stage tumors such a UPMC stage one through three have a pretty low risk of recurrence and it's the higher stage ones that are at a higher risk. This can be up to 20% depending on the extent of tumor. They should therefore be followed with serial imaging and six-month intervals are probably appropriate, but as Dr. Rowan said, the data around this is not so solid these are strict rules.

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