

[MUSIC PLAYING]

ALLISON

As you said, I specialize in airway and sleep disorder breathing in kids. So my talk today is on pediatric sleep disordered breathing. And just briefly, I have no financial disclosures.

TOBEY:

The objectives that I wanted to cover today is a broad, just improved general knowledge of pediatric obstructive sleep disorder breathing and obstructive sleep apnea. And also, just so patients-- just people out there can get a better understanding of the predictive value of both patient history and clinical exam alone for diagnosing obstructive sleep apnea, as well as severity of obstructive sleep apnea.

You get a better understanding and better at being able to identify which patients benefit from pre-operative or perioperative polysomnography. And then also, be able to better counsel patients as far as the perioperative success of adenotonsillectomy.

So before I get into a little bit more, I just-- any person who works with peds has understood this statement-- pediatric sleep and pediatric airway-- kids are not just small adults. And so, there are a few things related to the pediatric airway that I think you have to understand when you're dealing with kids, and recognize when you're offering treatment options for this population.

So one, their airway is not the same. Their airway is ever changing as they grow. Very small infants have smaller nasal passages, larger adenoid beds. They have smaller mandibles. All infants are born mildly retrognathic-- larger relative tongue. This changes as they grow. And so, when you're looking at their area of obstruction, and you're looking at treatment options, sometimes growth is the answer.

They have more collapsible cartilage, both in the larynx, but also in the lungs, which leads to a lot of respiratory issues, compliance issues, oxygenation issues, which then make the obstructive component worse. And so, all of these things do get better within time. And when you're counseling patients, and if they have relatively mild symptoms that have been short lived, options for waiting and growth are often an option to be discussed.

Other things to know when you're dealing with kids, is kids need more sleep. And so, a lot of times, we see families that come in with kids that are 6 years old, seven years old-- they're coming in because they're tired. And they-- your job as a pediatric otolaryngologist, or an otolaryngologist, is to decide if that-- they have sleep disordered breathing that are affecting their sleep quality, and sometimes, just figuring out how much they sleep.

This day in age, people are using a lot more electronics. They get-- they're out later. They have a lot more activities. They sometimes are in school with activities until 8 o'clock. They come home. They eat dinner. They're doing their homework at night. And so, if a child is not getting enough sleep, it can just be fatigue from that. And you're not going to fix that with surgery. And so, just being able to recognize that and ask appropriate questions.

Other things-- parasomnias are very common in kids. They typically are benign. And they typically resolve. And so, another very common thing that we get is a parent will come in with a four-year-old who is waking up screaming at night, and they think it's because they're obstructing and they're waking up. And these very well could be night terrors, and they're common. They are benign. They don't affect sleep quality at all, and they go away without treatment.

Bruxism is another one that's been linked with obstructive sleep disordered breathing, but is not always associated, and is often benign, and resolves. These are a couple of other things are common-- sleepwalking, rhythmic movements, and enuresis.

So when we look at sleep disordered breathing in kids, there's a spectrum. This is true in adults too. It starts with snoring, and then you have a upper airway resistance, prolonged obstruction, and then, it progresses into obstructive sleep apnea. And there's various degrees of severity of obstructive sleep apnea. And there's also various degrees of snoring, and not all snoring is benign.

And this is where a pendulum has sort of swung back and forth, in the last couple of years. Whereas, we used to treat all snoring, and then we decided we would only treat obstructive sleep apnea with surgical options. Now, we're just-- there are more and more literature supporting that there is-- not all snoring is benign, and often warrants treatment.

So couple of definitions that don't necessarily-- terms don't necessarily differ from the adult population as far as apnea and hypopnea, but how we get-- derive those definitions do. Pediatric sleep study-- this is all based on polysomnography and that's how we get our definitions of at least obstructive sleep apnea. And these definitions, and how we define apneas and hypopneas in kids does different from the adult population.

And they often do they often differ slightly with age too. So children under one are scored slightly different. And then pre-term kids are scored even differently. And so, this is important when you actually go to order a polysomnogram-- having it read by someone who is familiar with reading pediatrics sleep studies is important. Hypoventilation syndrome is also scored differently than it is in the adult population.

Another important thing-- this gets into the idea of non-benign snoring is this idea of respiratory effort related arousals. And these are airway obstruction or partial obstruction or decrease in airflow that don't quite qualify for an apnea or hypopnea, but yet affect the quality of the sleep. And these are not scored at all sleep centers, but they are important, because they do affect the quality of sleep. And anything that would improve this, either surgical or medical options, might improve the sleep quality of the patient.

So more definitions, sorry, before we go on. So AHI, RDI, and ODI-- they don't necessarily differ from adults. They have the same definition-- just how we derive them and how we score the sleep studies differ. So one last thing that does differ in the pediatric population is obstructive sleep apnea severity. And this is based on some general data pop-- patient populations and scoring-- looking at kids with without concern for sleep apnea or sleep disordered breathing and that's-- and then population data and they derive as far as normal, mild, and moderate to severe.

And so, in kids mild apnea is less than five, whereas in adults, that would be normal. Severe is obviously as greater than-- appear greater than 10 episodes per hour, or desaturation greater than 80. Now there is some debate in the literature and in practice as far as when do we decide that we are going to use an adult scoring system. And do we score 16-year-olds, 18-year-olds with pediatric scoring system or grading system? And that's something that is debated.

And we do have some kids that are 26 and they have craniofacial abnormalities that we still score with the pediatric criteria, but that can be debated as well.

The prevalence of obstructive sleep apnea in kids, it's very common. And this is-- it's probably more common than what we have reported in the literature, because every year when more data comes out, the number goes up and up. And part of that's because we're diagnosing it more. Part of it's because the obesity epidemic is increasing. But in the general population, most papers cite are somewhere around 10% to 12%-- previous studies-- a little bit less, as far as obstructive sleep apnea.

And habitual snoring can be as high as 50%. As far as habitual snoring, and what we would define as what's benign what's not, that really hasn't been looked at very closely. Certain populations within pediatrics have much higher prevalence, and those are the patients that have down syndrome, obese patients.

Patients with neuromuscular disorders or craniofacial abnormalities-- there isn't, to date, good literature that looks at the rate of snoring in these populations, but it is probably much higher as well.

Why do we care? So we care for a lot of the same reasons we do in adults. The cardiovascular morbidity is high. And a lot of these patients that have higher risk of having obstructive sleep apnea, such the downs population or the neuromuscular disorders. They also have much higher risk of having cardiovascular abnormalities, so we really worry about it in those-- that population.

In the teenage population, we worry about accidents-- motor vehicle accidents, work accidents. And then we do-- more and more literature is supporting this metabolic effect of sleep disordered breathing. But probably the largest data that's out there, and what that the presenting signs that we have in kids is the cognitive or psychological effects of poor sleep.

And that's behavioral problems, issues with mood, performance in school-- things like that. And this is where sometimes when we're assessing kids, and parents will come in and they have a three-year-old that has mood issues and tantrums and they have control issues, and some of this is normal for the age, but some of it could be also related to sleep. And we don't have great ways to differentiate that other than the polysomnogram.

Now, we know that there's these risks, and these things that we should be screening for, so who do we screen for? The American Academy of Pediatrics came out with guidelines in 2011. And essentially, every patient should be screened at every visit for signs and symptoms of sleep disordered breathing. And the Pediatric-- American Pediatric Academy does recommend any patient that has any signs or symptoms concerning sleep disordered breathing, they should get a polysomnogram.

They recommend for down syndrome-- they should be screened more closely. They should be referred sooner. And regardless of symptoms, they recommend a sleep study by the age of four. To date, we're probably at about a quarter of a patient's-- down's patients that are age four actually get a sleep study, and about a third of patients are actually being referred. So we're not meeting these guidelines by any means.

But at least in the down's patient, we know that parent-reported sleep issues are-- do not correlate with the severity of sleep abnormalities they have. And so, this is a population, in particular, we want to target a little more aggressively over the next couple of years.

So these guidelines there are some problems. We have issues-- we have a backlog of being-- and a resource issue with getting sleep-- pediatric sleep studies. And so, it's not feasible to have-- to screen all patients that snore, all patients that might be moody with sleep studies. And so, what are some of the other ways that we can screen them without getting a sleep study?

So we have questionnaires. We have history. We have physical exam. And in the pediatric population, there are there are two pediatric questionnaires that have been validated. They aren't in and of themselves very sensitive or very specific. In the adult population, we have the [INAUDIBLE], which is about 88% to 90% sensitive. We are not anywhere near that with kids.

When you look at exams, there's lots of things that we can look at to predict either the presence of obstructive sleep apnea or the severity, and that includes tonsillar size, Mallampati score, Angle's classification, and weight. There's lots of studies out there that show that each one of these individually is not very sensitive or not very specific. So four plus tonsils does not mean you have sleep disordered breathing.

There are studies that look at two or three of these and combined with questionnaires, and combined with history, and then we get better and better at predicting. But we're not-- we don't have great, I guess, algorithms to predict presence. This is one study that highlights that, looking at a metaanalysis of a lot of these studies. And once again, all of these things individually-- not very good at predicting presence of sleep apnea or severity.

This study seemed to think that obesity combined with enuresis was very sensitive. It's not very specific though. And then, in the little kids, especially under the age of six months, failure to thrive with witnessed apnea is pretty predictive. It's very sensitive. It's not very specific. So things are out there.

So if you look at that paper and metaanalysis and other papers, these eight criteria are probably the best combination of things that we have to predict obstructive sleep apnea. But not one of them solely is good alone. And we do get a lot of patients referred because of big tonsils, but they have no other-- none of these other things present. They're probably fine.

So who needs a sleep study? An American Academy of Sleep Medicine has come out with guidelines, as has the American Academy of Otolaryngology. And essentially, these are people that are high risk, have high incidence of obstructive sleep apnea, or are patients that their clinical exam doesn't quite correlate.

Or you have a patient, a parent or a family that is not really certain on which direction they want to go. It provides additional information to help guide them in as far as treatment. Definitely for repeat sleep studies, if there's any-- if there's previous presence of severe sleep apnea or any of these other high-risk neuromuscular issues or craniofacial abnormalities, it's worthwhile to do-- or persistent symptoms.

Now, I'll get into this a little bit more, but some of these other patient-- these patient populations, especially these here, we know they're very high risk for having obstructive sleep apnea, and there's more and more literature that's coming out that's supporting that getting preoperative sleep studies may actually delay care by up to about six months. And we know they're high risk. And if it's not going to necessarily change our surgical management, the pre-operative sleep study may be foregone and actually more reserved. The postoperative one might be more beneficial.

So polysomnograms-- what is it, and what-- pros and cons-- so it is our gold standard for defining obstructive sleep apnea. It's also-- and it also provides hardcore information about the severity. It's an objective study. So a lot of what we do to screen for pediatric sleep apnea or sleep disordered breathing, is subjective. But this is actual objective information. It gives you good information to follow progress with either treatment of any type, be it medical treatment, growth, or surgical interventions. It gives you good information on non-breathing related sleep disorders.

So nocturnal seizures, periodic leg movement disorder, or night terrors-- it gives you good information on that. So if you have a patient that you suspect doesn't have an airway abnormality that's causing their sleep disturbance, this is a great study to get. And then, some people have argued that it's-- you should use it for predictive value or perioperative risk. And I'll get into this in a little more detail. There is some benefit here, but it might not be the most cost-effective tool for predicting perioperative risk.

So some of the cons-- it's expensive. There is some out-of-pocket pay for-- some patients are paying \$6,000 for a study. We have limited resources. Very few centers are equipped to actually put the leads on kids. Very few people have technicians that are willing to or able to manipulate these leads. Kids move around. They often have pacifiers in, which affect the various leads. And you have to have a technician that's paying attention and adjusting these, because that's going to affect your data.

Often, patients will travel for hours to have a sleep study, and it's not something that's always tolerated by kids. We have a lot of kids that have autism spectrum or various sensitivity issues. And those kids don't tolerate this very well, or they don't sleep well. So you might have a family that traveled for hours. They were up all night because a kid didn't sleep and they traveled for hours. They're not really happy with you. And they also paid, maybe, \$6,000 for this study.

It can delay care. There is a lot of data that's emerging that it actually delays care, and it doesn't necessarily always change your surgical management. And then-- variability in it. There's variability in the reads. There's variability in time-- timing of this. Kids get a lot of colds. You do sleep study when a kid has a cold, it's going to be very different than if they're well. There's some variability as far as allergies and other things like that. So the pros and cons of sleep studies.

So predicting-- I just wanted to mention a little bit more about predicting perioperative risk. So in 2014, there was a study that showed that severe sleep apnea or significant desaturation or hyperventilation or CO2 retention on a polysomnogram predicted a higher risk of having-- a likelihood of having a respiratory event or respiratory complication post-operatively. And this is probably true.

And this has come back on other studies. However, there are more recent studies that actually show you can predict this same outcome, and actually the non-respiratory related perioperative complications by just history alone. And these top things are much more likely to have a perioperative risk-- so young age, prematurity, frequent URIs or the presence of active URI, asthma or any lung disorder, cardiac issues, neuromuscular issues. So all these kids should probably be treated more severe-- they're at a higher risk anyways, regardless of what the sleep study shows.

So who do we treat and how do we treat? So any patient that has a history that is concerning for sleep disordered breathing, has a clinical exam that meets it, family history is concerned, is prolonged-- they had a sleep study that consistent-- you can offer treatment. And treatment can be medical-- it can be surgical.

The first line of treatment for pediatrics-- the recommendation is to have surgery-- tonsil adenoidectomy. And we've been recommending this for a long time, as has the American Academy of Pediatrics. However, it wasn't until recently that we had good data to actually support this-- that's actually beneficial. And that is the childhood adenoid tonsillectomy trial-- the CHAT study.

And this was a multi-center, randomized, controlled study. And they chose patients-- because they wanted to look at neurocognitive functions, they chose patients that were five and up. And it's because neurocognitive testing is somewhat complicated, and a four-year-old or a three-year-old really can't do the testing. We do think that the three and four-year-olds probably benefit significantly as far as mood and neurocognitive issues, however we can't-- there's not-- we don't have the tools yet to study that.

So what they-- this study was designed, like I said, it's multi-center. Patients that were ages five to nine, that had high risk for snoring or history that's consistent for snoring, tonsillar hypertrophy, they were evaluated by either an academic pediatric ENT, or an academic sleep specialist, they were deemed a surgical candidate for TNA based on history and exam. Those patients underwent screening polysomnograms. And this was over 1,000 patients.

Almost 50% of those patients on the screening polysomnogram had a normal sleep study. So this gets into that-- we're not really good about-- we're not really good at predicting presence of obstructive sleep apnea. Now, some of these patients probably had non-benign snoring, and they probably still would benefit surgically, but that's something that's now being looked at.

Of those patients that had obstructive sleep apnea, they went on and randomized to a watchful waiting nonsurgical arm versus a surgical arm. And then, at that time of randomisation, they had questionnaires, they had neurocognitive testing. And then seven months after this, so either after surgery or watchful waiting, they repeated the polysomnograms, they repeated the neurocognitive testing, and they repeated all the questionnaires.

Now I have to comment here is the watchful waiting group was not necessarily standardized. So because there are multiple centers involved, sometimes medical options were offered to the patients, and that wasn't necessarily uniform. So it's-- watchful waiting including some of the medical therapies.

So what did they find? So seven months after, with the repeat polysomnogram, both groups had a decrease in their HI. So there was a significant greater decrease in the surgical arm than the watchful waiting arm. However, if you looked at actually cure-- so secure based on HI less than two, which is what they chose as their cut off, almost half of the non-surgical arm actually had a decrease in their polysomnogram less than two. But most of these kids were not symptomatic when you looked at the questionnaires that the families filled out.

They also, when you looked at the neurocognitive function, there was a trend for improved neurocognitive function with the surgical arm. This wasn't statistically significant, but there was a trend. Caregiver rating was also improved, as far as quality of life measures-- multiple quality of life measures and caregiver ratings. Now, you can argue that the caregivers are not blinded because they obviously knew if the surgery was performed or not, but the teacher rating was also-- showed significant improvement. And teacher rating is somewhat blinded, but they could probably-- there's probably some way that they can figure out if there was surgery not performed.

And if you look at other studies looking at the outcomes for tonsil adenoidectomy, we are pretty good at being, for the general population, as far as having a cure, or at least providing a significant reduction in HI, in the general population. If you look at these other populations that are at high risk-- downs, neuromuscular issues, or obese patients-- we are not really good about curing their sleep apnea with just tonsil adenoidectomy alone. However, we can reduce the HI, and-- and I don't have it up here-- but if you look at quality of life measures for all of these groups, we-- tonsil adenoidectomy does seem to show a trend for improving quality of life measures.

Patients that are less likely to have complete response with surgery are patients that are [INAUDIBLE] aerobic, patients that start off with severe sleep apnea, obese patients, African-American patients, older patients, or patients that have some type of inflammatory issue. So when you're counseling patients, keep those in mind.

So I wanted to mention a bit about surgery for not-- for sleep disordered breathing that's not obstructive sleep apnea, and I lose this non-benign snoring-- there's an abundant subjective data that's out in the literature that supports surgery for non-benign snoring, or upper airway resistance syndromes, or inflammatory issues that are related to sleep disturbances, so asthma or allergies that cause sleep disturbances.

And so, surgical options, or at least some type of treatment, this can be medical too, should be offered to these people, even if they don't have obstructive sleep apnea on a polysomnogram. And then there's an emerging objective data to support this as well, as far as neurocognitive testing on patients that are after surgical treatment.

In summary, sleep disordered breathing and obstructive sleep apnea is common in the pediatric population. The pediatric airway is different than adults. It changes with growth. And therefore, you should consider this when you're thinking about treatment options in kids. Clinical exam and history alone are not very sensitive or specific in predicting the presence obstructive sleep apnea or the severity.

Polysomnograms are useful, and more useful, probably, in certain populations. And then tonsil adenoidectomy is very successful in treating, but not always curing, obstructive sleep apnea. And there are certain populations that you should know about when counseling patients that are probably more likely at risk for having persistent symptoms.

And then tonsil adenoidectomy may be beneficial in symptomatic patients that in the absence of obstructive sleep apnea.