

Dr. Alyssa Smith:

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Hello, everyone. Welcome to another episode of ENT in a Nutshell. My name is Alyssa Smith. Today we're joined by pediatric otolaryngologist, Dr. Kara Meister. In this episode, we'll be discussing aerodigestive foreign bodies in pediatric patients. Thanks for being here, Dr. Meister.

Dr. Kara Meister:

Thanks, Alyssa. Thanks for joining me and inviting me to participate. This is awesome.

Dr. Alyssa Smith:

All right. So when thinking about these patients, what signs or symptoms do they usually present with?

Dr. Kara Meister:

Yeah. I think the most important thing, and you'll hear me say this over and over again probably, is never trust a baby. So there are definitely those classic signs and symptoms that kids will present with. Then you have to just take it at face value and anticipate that things could get a lot different very quickly.

But the classic things that we're looking for is noisy breathing, particularly stridor or wheezing. Parents aren't always able to tell you, "Oh, my baby has stridor." They may say, "My baby makes a noise," or, "My baby is wheezing." Coughing is a very common symptom either in the history or during presentation. Respiratory distress would be a late finding, and all the things that go with that. So tripodging or inability to control their secretions, retractions. All those things are more late-stage and worrisome.

There's also occasionally the child that won't lay flat. That can be because of difficulty managing secretions, or sometimes it's just because they can't breathe at all. Along those same lines, there are kids that won't eat. So if they don't want to do their normal activities, we may have more suspicion.

Dr. Alyssa Smith:

Then are there any kids that are completely asymptomatic?

Dr. Kara Meister:

Yeah, absolutely. Again, never trust a baby. If the history is suggestive and they don't have any of those classic symptoms, there could still be something lurking down there. And so, it's one of those things where if the parent gives you a history, especially if you also have physical exam or radiographic exam findings, they could look like a peach and be hiding something scary.

Dr. Alyssa Smith:

Then what are some common foreign bodies that you'd seen in your experience?

Dr. Kara Meister:

Oh, man. Kids will put everything in their mouth. So the most common, nuts, seeds, coins, batteries, pieces of toys. The most interesting that I saw in the past year or so was an infant who got a hold of her mother's earring that was shaped like a bow. So if you imagine the loops of the bow and then the post of the earring, the loops were lodged in her esophagus and the post was facing anteriorly into her

cricoid. And so, that was quite an interesting case. But they'll put anything in their mouth and they'll do it more than once.

Dr. Alyssa Smith:

Then does presentation change at all with the different types of foreign bodies? For example, food versus something made of metal such as a coin.

Dr. Kara Meister:

Yeah. So not necessarily. It's not as specific to the type of foreign body itself as it is to size and what the edges look like and then what the foreign body is made of. We think of things like legumes and nuts as having the potential to swell in the airway. We think of things like button batteries, which we'll cover a little bit more in detail in the subsequent part of the podcast. But those can present a very different story. So there's not like, "Oh, if you hear this noise, it's definitely a penny," but there are findings related to the size, the material, and where the foreign body is lodged.

Dr. Alyssa Smith:

Then I think we've all heard how damaging button batteries can be. What actually makes them so damaging?

Dr. Kara Meister:

Yeah. So that is something that has been debated for a while. Right now the current thinking is it's that negative anode of the button battery itself. It's essentially creating a small electric field there. Oftentimes people will think that it is "leaking" acid, and it's not doing that. It's actually creating a field in that microenvironment. We can talk about this more later, but one way to remember that is that if you can break that field temporarily, you can stave off some of the injury that the battery will cause.

Dr. Alyssa Smith:

Then when a child does ingest a foreign body, where are the most common locations that it can usually become lodged?

Dr. Kara Meister:

It depends. It can get lodged anywhere from the nose to the carina, to the lower esophageal sphincter as far as our otolaryngology anatomy is concerned. And so, the most common areas in the airway itself has a propensity to go towards the right mainstem bronchus.

The reason for that is it's shorter, fatter, and more upright. And so, if you want to play any games, it's easier to hit something that's bigger, that's more upright because of gravity, and has that orientation. So it likes the right mainstem bronchus.

And the esophagus, which is more common, actually twice as frequent as airway foreign bodies. Think about any of the areas of the esophagus that are anatomically narrow. So the upper esophageal sphincter, the aortic arch, the thoracic inlet over the carina and mainstem bronchi, and then the lower esophageal sphincter.

Just beyond the cricopharyngeus is the most common of all. It tends to be seen that we see coins more commonly in the esophagus, and part of the reason is because they're flat and they fall along the posterior wall as the child is swallowing them.

They usually will swallow coins and toys in a more calm state. They usually swallow nuts and popcorn as they're running across the room. And so, kids are more likely to inhale those particles and have a disorganized breathing and swallowing, which makes them end up in the airways. While esophageal foreign bodies are definitely more common, you have to think about the story as well.

Dr. Alyssa Smith:

And so, when we're evaluating these patients and we're thinking about the story, what are some important history questions that we should be asking either the parents or the patient even, if they're old enough?

Dr. Kara Meister:

Just like any patient, you want to take your complete history and physical. So the one caveat in this scenario is if you do your eyeball test and the child looks unstable, you really need to prioritize securing the airway rather than talking about some of their other past medical history. So everything that I say about this is under the caveat that you have a child who's stable enough to allow you to gather more information.

So in the history, you want to know did they cough? Did someone see them put something in their mouth? I recently took care of a patient where dad found 19-month-old twins next to a bag of batteries. That is suspicious in the history. The other thing that's interesting along those lines is oftentimes they'll have a very helpful sibling who feeds them something that they maybe aren't quite ready for, so I always ask if there's a sibling in the house and if that person has fed them things.

Of course, developmentally delayed children will find things and put them in their mouth. If a child is having repeated foreign bodies, then you have to think about, more from a pediatrics standpoint, are there social concerns in the family or does the child have an underlying medical problem that may be prompting them to put all these things in their mouth, such as esophageal problems and iron deficiency, pica type of things?

Dr. Alyssa Smith:

And so, usually the next step in our workup is our physical exam. What are some key physical exam findings that we should have in the back of our head?

Dr. Kara Meister:

Yeah. So number one is stable or unstable. Is this child safe or not safe? What kind of emergency is this? Then number two, do we think there's a possibility of a battery in there? The physical exam really is predicated on those two points in the algorithm.

Of course, you want to look in their mouth and look at their oral mucosa. If the child is drooling, you want to note that. If they have any nasal flaring or tracheal tugging, you want to note that. I think it's important to observe what position the child is in. Of course, a complete long exam is very helpful. It's best if you can get the child to be calm during this. The quality of their voice is also helpful. If you note any stridor or extra luminal airway sounds, those also can be very helpful.

Dr. Alyssa Smith:

Then how about radiology? Do all patients need imaging? When you are getting imaging, what type of imaging are you getting?

Dr. Kara Meister:

Yeah. So if you have the time, getting imaging can be very helpful. The gold standard of airway foreign body is an x-ray. So you need both anterior-posterior, as well as lateral. That can help you localize tracheal or esophageal foreign bodies or either further down.

The other thing that's important on a plain film, if we're having both the AP and lateral, is if you are in a situation where there is a button battery, you can see that double ring sign on anterior-posterior, but the lateral view actually can tell you a clue about where that negative anode is facing. And so, that area will be more narrow.

The saying is negative, narrow, necrosis, which means that where that negative anode is facing is going to be more narrow on your plain film and the area of coagulative necrosis most likely. And so, it's nice to know if that's facing anterior or posterior.

Then beyond button batteries, if we're thinking that we have an esophageal foreign body, say a coin, most of these are radio-opaque and we can see with measurement what it is. There are other findings on plain film such as hyperinflation or localized atelectasis, infiltrates.

It's not uncommon for kids to swallow things when they don't feel well. And so, it's nice to see if you also have something else going on like a viral picture. Or if the history suggested that this may have been going on for more than 24 to 48 hours, it's also nice to know if the child has what looks to be a post-obstructive pneumonia or collection there.

I tend to not get much other imaging before taking the child to the operating room, with the exception that if it isn't esophageal foreign body and the child has a clinical change, meaning that they're now swallowing and look a little bit brighter. Before I go under general anesthesia, I'll often repeat that film, especially if it's been more than four to six hours.

Dr. Alyssa Smith:

Then when we're thinking about deciding who exactly needs to go to the OR for evaluation, what happens if the history is discordant with the physical exam or the imaging? How do you determine who needs to go?

Dr. Kara Meister:

Yeah. So it's a great question. In this era of COVID-19, which is we're in the height of it at the recording of this podcast. It's April 16th, 2020. So it's really called into question how many are aerosol-generating procedures we are doing and if we're doing too many and really fighting for the necessity of every case to be proven. Airway and esophageal foreign bodies are one of the cases that's escaped with this, meaning that we want to take some kids who have a negative exam because we don't want to miss this. This is a not-miss problem.

So for me, I go with the two-thirds rule. So if they have a convincing history and a convincing exam, but their radiograph is negative, I will take them, vice-versa. If they have a convincing history and their imaging is suggestive, but on physical exam they look okay, I'll still take them, because to me the risk a negative trip to the operating room is okay, it's tolerated because we're looking for something severe.

Dr. Alyssa Smith:

Then is there any limit to the location of these foreign bodies in which we should be involving other teams? For example, really low in the esophagus or in the airway.

Dr. Kara Meister:

Yeah. I think that some of that is dependent upon your institutions. There are a few nuances to this. A lot of listeners are probably thinking about pediatric fellowship. Of course, we want to have wonderful training for all of our residents and fellows. And so, we try to fight very hard, plus these are fun cases to do, to have otolaryngology as a presence in all of these cases.

We do try to involve other services because a team approach is almost always the best thing for the patient. Certainly, there are cases where you're reliant on a team approach, such as the button battery. So if the button battery is lodged in the esophagus, your GI colleagues will be well-versed in administering acetic acid intraop. Perhaps you may need a cardiothoracic consult, either intraop or postoperatively, to look at its proximity to great vessels such as the aorta. So there are definitely those types of severe cases where a true multidisciplinary aerodigestive approach is best.

The other consideration is just your institution's culture. At Lucile Packard, we will often split the esophageal foreign bodies our GI colleagues. They're much better at taking out soft things through their scopes, like shredded chicken or some vegetable matter. Every now and then, we will benefit from our pulmonology colleagues assisting in flexible bronchoscopy to clear post-obstructive secretions. And so, I think being open to a team approach for all of these can really serve the patient.

Dr. Alyssa Smith:

Then how about urgency? When should we be thinking about OR timing and how quickly we're getting these kids to the OR?

Dr. Kara Meister:

Yeah. So it's a great question and one that every otolaryngologist will encounter in his or her career. The answer is the patient will tell you. So if the patient is unstable either from an airway standpoint or a swallowing impairment that's so severe that it's become an airway concern, that patient needs to go right away. We're not going to take any time there.

The button battery also needs to go right away. Those should be cases where if you have the benefit of a nice transfer or triage center, you can already start having those wheels in motion before the patient arrives.

So these patients should ideally go from their preoperative care straight to the operating room. You don't want them to go to the general floor and get admitted. They need to be on an expedited protocol.

In contrast, if you can wait until daylight hours, that's often preferred for esophageal foreign bodies. For example, if a quarter comes in in the night and the child is stable, we will often wait until the first start to take that case to the operating room. We can wait on NPO violations in that setting as well. Whereas we don't have that luxury for every foreign bodies or button batteries.

Dr. Alyssa Smith:

So for button batteries in particular, is there anything that can be given to help mitigate the damage done by these before we're able to get them to the OR for retrieval?

Dr. Kara Meister:

Yeah. So that's a great question. There's been some really interesting work in pig models over the past 18 to 24 months that shows that good old-fashioned honey is a nice way to coat the battery and really

break up that electric field. If we remember back to our physiology of how these cause damage, the idea is that the honey will coat the battery and there won't be that continued injury.

A few things to know about honey. Obviously, kids have to be over a year old because there's still a risk of botulism, which we don't want to introduce. Actually, good old-fashioned honey is better than fancy artisanal honey, because those can have wildflowers and other substances that in excess aren't great for kids.

You also want to make sure that the parents understand that they shouldn't go to Safeway on the way to the hospital. They should just come to the hospital. If they have the honey, great. Throw it in the car. Give them a whopping tablespoon every 10 minutes. If the ingestion has thought to happen greater than 12 hours ago, then don't give the honey because there's a significant risk of esophageal perforation.

The other substance that's been investigated is Carafate. Carafate works in the same way. The basic science data looks to be a little bit more promising actually for Carafate than honey, but the truth is not a lot of families have Carafate hanging out. So you can order it in the emergency department. It sounds like there's an ambulance, hopefully not with a button battery, on the way. But they can go ahead and give it as soon as they could get it, so the ED, if it's going to take 20, 30 minutes, an hour to mobilize your operating room.

Dr. Alyssa Smith:

Then when we are mobilizing the operating room, what should we be doing before the patient arrives?

Dr. Kara Meister:

Yeah. So this is one of those cases where you want to make sure that everything is prepared. And so, the key to a successful airway or esophageal foreign body is never trust the baby and have everything ready to go.

And so, I personally like to have a rigid bronchoscope set up for every case, including esophageal foreign bodies, because they could travel. The child could aspirate it during an attempt at removal. I've had an esophageal foreign body that was so large that it caused airway obstruction. And so, having a full set-up is imperative.

I personally like optical forceps. I usually start with a peanut grasp first. I also like to have two light sources because I find it cumbersome for our staff in the operating room to go back and forth sometimes. And so, having two light sources really frees up that step of having to transfer the light cable.

Dr. Alyssa Smith:

Then how about our discussion with the anesthesia? What should our induction, type of ventilation, and then maintenance of anesthesia be?

Dr. Kara Meister:

Yeah. So it's really a team approach. As with most pediatric airway, we prefer the child to be spontaneously ventilating so that they're breathing on their own. That's a hallmark of this. If they, of course, need to give positive pressure for recruitment, you just need to have that conversation that we can deepen or embolize that foreign body.

The other thing that can really facilitate your operative management is if you have time and the child will tolerate it, giving a racemic epinephrine nebulizer on the way to the operating room can help

constrict some of the soft tissue and make removal less bloody and a little bit easier. So I also elect for that.

Of course, with any shared airway case, just use good judgment, communicate. This is one of the cases where I don't have music on in the operating room. I think it needs to be an all hands on deck.

Dr. Alyssa Smith:

Then when you're performing your evaluation, what instruments are you using? What steps are you going through?

Dr. Kara Meister:

Yeah. Some of it depends on how stable the child is. I also feel pretty facile in flexible bronchoscopy. So I usually will start with a Phillips 1 laryngoscope and take a look at the airway. The other trick is that I usually will repeat my lung exam as the child is being masked, getting induced, because sometimes you can hear things during that that you didn't appreciate previously.

Most children, a Phillips 1 is a nice place to start. I also like to have a Phillips 2 blade because that allows you to scoop up the larynx and see the postcricoid space pretty easily. It's a great introducer of the esophagus scope.

Like we talked about earlier, I like to go ahead and have my optical forceps, usually the peanut grasper, and esophagus scope available. The other thing I like is that flexible bronchoscope to clear out any secretions post-bronchoscopy. In a pinch, it can also be used as a flexible esophagus scope.

Dr. Alyssa Smith:

Then I know some foreign bodies are typically more difficult to retrieve. For example, a round foreign body but smooth edges. What instruments or techniques are available for us in that situation?

Dr. Kara Meister:

Yeah. That's a great question. It depends a little bit if you're in the esophagus or in the airway. But there are all types of small catheters that can be used to pass the instrument and move it more proximal. The other thing that you can use there is a bronchial blocker, which comes in small sizes and has a nice, long wedge shape. That can be used.

The other thing I will occasionally do is if you take a flexible suction catheter and you cut the whistle tip end of it so it's blunt, either a 10 or 12 French, you can sometimes snake that down and pull the round foreign body out that way.

In worst case scenario, I have been in a situation where we needed our pediatric surgeons to perform a VATS to get at a foreign body from above and below to get it mobilized. You just have to remember to keep an open eye. There's a lot of tools in our wheelhouse. Always start with what you're most comfortable with.

Dr. Alyssa Smith:

Then I think the situation that we all are afraid of is if the airway foreign body becomes lodged in the trachea and completely occludes the airway. What do we do in that situation?

Dr. Kara Meister:

Yeah. So it depends on where you are, if you're in the emergency department or if you're in the operating room. But really the problem that you have in that situation is a completely obstructed airway. You need to get oxygenation into this child in some other path.

So this is a time where you need to call for help. You should call either a senior partner or someone else who's in the operating room. It's a great time to also call your ECMO team. If you're in a place where you cannot oxygenate, cannot ventilate, that is an indication for ECMO in the pediatric population.

In the meantime, you should keep working on the airway. One of the things that you can do is if you're in the proximal trachea, just try to decide to go down. So if you have something sitting in the mid-trachea, just push it somewhat gently towards the carina. Then if you can, mobilize it into one of the mainstem bronchi. Then you can at least ventilate one lung.

But while you're doing those more advanced maneuvers, calling for help, and potentially ECMO is a great thing to have already done. It's a lot better to be calling those teams off than wishing you had called them sooner.

Dr. Alyssa Smith:

Definitely. So after you perform successful retrieval of your foreign body, do you then go and look again?

Dr. Kara Meister:

Yes, for a few reasons. Number one, it's because kids will put anything in their mouth, and sometimes multiple things. The classic story that we hear is a child that swallowed pistachios or popcorn where they have pieces or flecks of it. So I almost will always look in whichever organ did not have the primary foreign body in it also, as long as the child is stable.

For example, if there's a quarter, I do like to look at least in the trachea and be sure that, a, there's nothing there and, b, that there's not a lot of collateral damage or aspirated secretions or anything like that. I like to look for multiple reasons: collateral damage, second, foreign body being the most prominent.

Dr. Alyssa Smith:

Are there any common pitfalls or mistakes that you've seen trainees make that we should be thinking of avoiding?

Dr. Kara Meister:

Yeah. I mean I've said it so many times now, but the most important thing in any pediatric airway case, and these especially, is just never trust a kid because they can go down quickly. What you think may be a very straightforward foreign body can get hairy pretty quickly. And so, always being prepared, going through the same thing every time is super important.

The other thing is just keep your calm. There is a very strong chance that you can manage this and you can get through it. Keeping calm, the saying of take your own pulse first is important in these.

They're fun cases to do. I know that they can be a little bit anxiety-provoking, and for good reason. We should take them very seriously. Being prepared is the first step in that.

Dr. Alyssa Smith:



So what happens after retrieval? What does post-op care look like for these patients?

Dr. Kara Meister:

Sure. It depends on what it was and where it was. If it is a coin that was there for a short amount of time in the esophagus, atraumatic retrieval, you looked post-extraction and the mucosa looks healthy, the kid will eat in PACU, I will often send those children home straight away. Obviously, a button battery is a completely different trajectory.

Airway is a little bit trickier. I want to make sure that the child can tolerate their wake up, if they're not having a lot of bronchospasm or lower airway inflammation or reactivity. I also want to make sure that their oxygenation is appropriate postoperatively. If there's been work beyond the carina, I get a chest x-ray often to make sure there was no inadvertent pneumothorax or any postoperative complication there.

Many times I will observe those children for some time, usually a day. But depending on where they live, if they're many hours away, definitely overnight as well.

Dr. Alyssa Smith:

Then you mentioned that post-op care was a little bit different for a button battery. What do we do differently for those patients?

Dr. Kara Meister:

Yeah. It depends on what the intraoperative examination looks like. And so, this is a situation where it's very important to document your measurements of where the injury was, take some great photographs, and layout the landscape of what the injury looks like.

Then, postoperatively, your main goal is to anticipate, prevent, and treat complications. And so, the complications of a button battery can go on for months. But within that first 28 days is when the highest chance for an adverse outcome can occur.

So immediately afterwards, you want to think about airway management in these kids. Oftentimes, their esophagus is so inflamed and painful that they won't swallow. This is sometimes an indication to keep the patient intubated after the surgery. If the patients can tolerate it, I will often nasally intubate them at the conclusion of the case.

The reason for that is because it's a lot more tolerable to have a tube in the nose than a tube in the mouth. Then, occasionally, we can have the child awake enough to get a sense of if they're going to tolerate their secretions after extubation.

The other important consideration in these children is that the button battery can injure one or both recurrent laryngeal nerves because of its location. You have to be prepared post-extubation for that whole gamut of scenarios and what that means.

The last thing is in that immediate perioperative period, it's often wise to get contrasted cross-sectional imaging, either CTA or MRI. You really need tissue between your injury site and where your great vessels are. Definitely, for esophageal, button batteries, I also look at the airway to see if there's been tracheoesophageal fistula.

Dr. Alyssa Smith:

When you say look at the airway, does that mean going back to the OR for repeat endoscopy?

Dr. Kara Meister:

It does, yes. So if the injury is severe enough, I will take them back to the operating room for repeat endoscopy at a time course that's dependent on their clinical trajectory and how severe their injury was. The TEF can present certainly right away if severe enough, but more commonly in that week to three-week time course afterwards. And so, I like to take a look at the airway.

Of course, if there's any clinical concern, you could do it earlier. Usually, your gastroenterology colleagues want to look at the esophagus around that same time, too. And so, it's a nice thing to do together, again emphasizing that multidisciplinary approach.

Dr. Alyssa Smith:

Then is there any role for antibiotics or steroids?

Dr. Kara Meister:

Yeah. This is very institutionally dependent, I do believe. Some of it depends on how severe the injury is. And so, some people will say that if you have a full thickness injury, you should cover them with full mediastinitis antimicrobials, including antifungals. Other institutions don't feel as strongly.

Steroids, similarly, from an edema standpoint, it can be very helpful. But we also don't want to impair any wound healing as well. So I think some of those can be, again, time decisions.

Dr. Alyssa Smith:

As far as diet goes, what is the timing of restarting a diet look like?

Dr. Kara Meister:

Yeah. So most often, the classic teaching is to leave a child on a soft diet through their first four weeks post-injury, because we don't want to propagate or worsen the injury. We want to promote healing. The other consideration is that the child has to be swallowing their saliva, tolerating their secretions. You should not have any concerns about their recurrent laryngeal nerve function also.

So we typically will have our inpatient feeding team evaluate these children before starting any PO. The esophagus in button batteries will often stricture. So the swallowing exam that you get two weeks post-op could look a lot worse at a month post-op if there's a stricture there. And so, it's important to keep following these children for at least that first month, if not three months, after.

Dr. Alyssa Smith:

I think you've already mentioned a few of the complications that we should be thinking about, but are there any others?

Dr. Kara Meister:

Yeah. So it can be divided up into early one month out and then late complications. So early things, think hole. So a hole between the esophagus and the trachea, a hole between the esophagus and the mediastinum, a hole in the lung becoming a lung abscess or empyema. Then a hole that is so expansive and inflammatory, it hurts the nerves.

So then going out that one month, we want to think about erosion, so further erosion from a tracheoesophageal fistula that has formed or erosion into the great vessels, can happen up to four

weeks post-injury. Then months later, we're thinking about scarring, stricturing, inflammation of the spine.

Dr. Alyssa Smith:

Then, finally, looking at the natural history of this, if no treatment is pursued, we leave the foreign body there, what might we expect to happen?

Dr. Kara Meister:

Yeah. So it's an interesting question. It depends on where it is and what it is. So the body does not like foreign things in it as a general rule of thumb. Say, for example, if you have a retained popcorn kernel in a subsegmental bronchi, the body will form an abscess around that. It can present as recurrent pneumonia or an empyema. It can even cause such an inflammatory response that you can get a stricture that completely blocks off that portion of the lung. The body will do amazing things to wall these things off.

Similarly, in the esophagus, I take care of a patient that very likely has an H-type tracheoesophageal fistula from a retained foreign body. There's no way to know that now, but just looking at his anatomy of his fistula and the tissue around it, my suspicion is that was a retained foreign body at some point.

So I guess in a lot of words, what I'm trying to say is that it's not good to leave it there. If you leave it there, it depends on how the body tries to get rid of it. But it can lead to really bad things like stenosis, holes, and severe infections.

Dr. Alyssa Smith:

Then thinking about esophageal foreign bodies in particular, do you ever see these just pass on their own?

Dr. Kara Meister:

Absolutely. So the esophagus has a natural peristalsis and it can certainly pass. The urgency really of removing it really depends on if the child's having any airway symptoms caused by the esophageal foreign body and the ability to get to the operating room safely.

Again, kind of like what we talked about earlier. There's no harm in repeating your radiograph before taking the child under general anesthesia if you either have a clinical suspicion that it's changed or there's been a significant time lapse between the two. I will occasionally use an ultrasound also to look if I know exactly where the foreign body is, instead of exposing the child to a radiograph.

Dr. Alyssa Smith:

So in summary, common presenting symptoms for patients with foreign bodies include stridor, wheezing, coughing, respiratory distress, drooling, dysphagia, food refusal, as well as emesis. However, it's an important concept to remember that patients can present asymptotically.

When evaluating the patient, it's important to ask about witnessed foreign bodies and any thought about what the foreign body might be. This includes asking siblings if there are any. Chest x-ray findings can include a radio-opaque foreign body. You can also see some hyperinflation or localized atelectasis or infiltrates in the lungs.

Retrieval of button batteries is an urgent matter to prevent additional damage to the mucosa. The patient should be kept spontaneously breathing during retrieval in the OR to prevent use of positive

pressure. Then after retrieval of the foreign body, a comprehensive evaluation of the airway and upper esophagus should be performed to rule out the presence of any additional foreign bodies and also assess for damage. So, Dr. Meister, thank you again for joining us. Is there anything else you'd like to add?

Dr. Kara Meister:

No, I think that sums it up. Yeah, the thing is just to keep an open mind and be prepared with excellent communication across not only your anesthesia colleagues, but our gastroenterology colleagues, pediatric surgery, pulmonology, and definitely the intensivist if the child needs a higher level of care. So one of the great things about practicing pediatric otolaryngology is that you get to work in a team and take care of these kids and really get them feeling better quickly.

Dr. Alyssa Smith:

Awesome. So I'll now move on to the question portion of this podcast. As a reminder, I'll ask a question, pause for a few seconds, and then give the answer.

So the first question is what are some common findings on chest x-ray for patients with an airway foreign body? So first it's important to remember to get both an anterior-posterior, as well as a lateral x-ray. When you're evaluating specifically for a button battery, and this could be in the airway or in the esophagus, you can see a double ring sign on anterior-posterior. Then also the narrow segment on the lateral view. It's, again, important to remember negative, narrow, necrosis. Some common findings in the airway can be hyperinflation as well as atelectasis for infiltrates.

The second question is what is the postoperative regimen after retrieval of a button battery? So these patients should have flexible laryngoscopy before starting any diet. They sometimes may have difficulty restarting their diet and, therefore, assessment of swallowing is important to make sure that they can tolerate a diet. It's also important to take them back to the OR to do a repeat endoscopy to look for any of the complications that we discussed such as a fistula between the esophagus and the trachea.

Then our final question is what are some common locations for foreign body to become lodged in the esophagus? So the four areas of narrowing that we think about in the esophagus are at the upper esophageal sphincter, at the area of the aortic arch, over the mainstem bronchus, and then at the lower esophageal sphincter. That's all for today. Thanks for tuning in.